LEARNing Landscapes

Journal

Teaching With Technology:
Pedagogical Possibilities
and Practicalities

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Table of Contents

Autumn 2017, Vol. 11 No. 1

Statement of Purpose

LEARNing Landscapes^{TM} Journal is an open access, peer-reviewed, online education journal supported by LEARN (Leading English Education and Resource Network). Published in the spring and autumn of each year, it attempts to make links between theory and practice and is built upon the principles of partnership, collaboration, inclusion, and attention to multiple perspectives and voices. The material in each publication attempts to share and showcase leading educational ideas, research, and practices in Quebec, and beyond, by welcoming articles, interviews, visual representations, arts-informed work, and multimedia texts to inspire teachers, administrators, and other educators to reflect upon and develop innovative possibilities within their own practices.

Review Board (Vol. 11 No. 1)

Editorial

It is hard to believe that this issue marks LEARNing Landscapes' journey into its second decade. We are pleased to report that we have now featured a total of 334 peer-reviewed articles from 21 different countries. LEARNing Landscapes also boasts a total of 101 commentaries, including authors/interviewees who loom large in the field of each themed issue, alongside highly regarded practitioners and an engaging range of student voices. We are indebted to an array of 218 competent and conscientious peer reviewers and to the LEARN support team that make each issue possible. We have migrated to the Open Journal System platform, which is increasing our scope and reach, automates our review system and analytics tracking, and allows us to provide regular updates to our community. We feel we are well positioned to continue this rewarding work in the future.

In 1995, almost three decades ago, Hooper and Rieber posited a five-part pattern they identified in which technology had been adopted in education at that time. The first was *familiarization* where teachers learned about the technology. The second was *utilization* where teachers tried out the technology. The third was *integration* during which time teachers assigned certain tasks to technology. The fourth was *reorientation* where teachers then focused on student learning and the fifth was *evolution* where ongoing change was monitored (p. 3). Aside from the fact that processes are never truly linear, with the rapidly evolving technological changes that educators are witnessing, there is no time to learn and try out technology in advance of the learners. Instead, teachers must have the confidence to jump in and learn with the students, acknowledging that teachers cannot be all knowing, and to embrace the idea that at least some of the learners may actually be the most apt technology teachers.

Morris (2017) has identified six ways that technology is changing teaching and learning. There is much more flexibility in the contexts in which teaching and learning can take place. There is a fundamental change in the ways that learners access knowledge and the ways they can interact with others. Current technology helps teachers to create more interactive, engaging, and flexible materials. It provides ways to be more diverse and inclusive in teaching approaches and permits multiple ways of communicating with learners. It is well theorized that all actions/tools mediate understanding in materially different ways (Wertsch, 1993), that learning is social and contextually constituted, and that collaboration expands perspectives and helps to scaffold learning (Vygotsky, 1980). The potential of technological tools is therefore vast, exciting, and probably impossible to imagine. The possibilities are infinite and the responsibilities weighty. With this in mind, I invite you to enjoy the interesting commentaries and articles that follow.

The articles in this issue appear in alphabetical order, in both the commentary and peer-reviewed sections. For ease of discussion in this editorial they are arranged thematically.

Invited Commentaries

We are grateful for the wise and interesting commentaries on digital technologies provided in our interviews with a researcher, digital consultant, practitioner, and biologist/artist/healer. They create a helpful backdrop of ideas for the articles which follow. **Anne Bamford**, a researcher who works for the International Research Agency out of the UK, discusses in a compelling interview how she first became interested in virtual learning because of cyberbullying. Believing strongly that visual manipulation can affect perception, she discusses her well-known study that examined the impact of active 3D learning using 3D glasses with students in 10 different countries. Her results showed that students achieved better test scores, and, even more importantly, their percentage of improvement increased substantially. She argues that student engagement and involvement in technologies are fundamental for creating successful virtual schools, and that schools of the future require student ownership of, and involvement in, their learning, and a substantial change in how teachers are prepared in terms of pedagogy, assessment, and evaluation. **Dean Shareski**, a digital consultant and the Community Manager for Discovery Education Canada, shares in his interview how he believes the fundamental aspects of authentic learning, in digital or any other contexts, are joy, play, wonder, and community. He discusses with examples how joy is an inward and outward sense of well-being, play is the willingness to try something new, and wonder is the process of noticing in everyday experiences. He suggests strongly that teachers need to see themselves as artists and must be able to articulate their special talents. They deserve validation of their work, which happens all too infrequently. His final advice to teachers is to "let kids be kids" and to be conscious about modeling for students what a healthy adult life looks like. **Kish Gué** is an Information and Technology Pedagogical Consultant for the English Montreal School Board. His enthusiasm about using technology in the classroom is palpable, but he underscores that it has to be based solidly in excellent pedagogy. He describes in some detail a project titled, "Tune Into Culture," in which the students used QR code technology linked to podcasts that they created. He played a role by helping teachers and students to use the necessary audio software. Student motivation was high because the work was "real" and he suggests that this kind of work is like "planting a seed" for what students can do later in life. His advice to teachers is to have the courage to be vulnerable, and to surrender control and learn about technology with their students. He encourages novice teachers to start small, but to jump in, emphasizing the need to integrate technology into the curriculum and to create flexible learning spaces in which to do this. He urges parents to keep abreast of what their children are using and doing with technology to help foster responsible digital citizenship. **Artemis Papert**, biologist, artist, and Shiatsu healer, describes how the computational thinking developed in acquiring computer programming skills can help students organize their thoughts more formally. She discusses TurtleArt, a worldwide software program developed by her partner Brian Silverman and his colleague Paula Bonta. TurtleArt allows both children and adults to create two-dimensional, static art images using geometry and coding as a medium. She explains how the beauty of this software is that it bridges math and art and is very easy to learn. She suggests that when using TurtleArt, people who are more mathematically oriented will do artwork, but will think they are doing math and programming. In contrast, people who are art-oriented will feel they are doing art, but will acquire programming skills in the process. She reminisces about being brought up in the Papert household and maintains that the

ideas her father, Seymour, discussed in his 1971 article, "Teaching Children Thinking," are still relevant today. His vision was an educational system where technology is used not just for processing, but as a way to manipulate, extend, and apply knowledge—a way for students to create and think about what they are doing in order to develop intellectual agency and a sense of the power in applying the knowledge. Together these commentaries point to the increasing importance of technology in schools of the future. They underscore the necessity for technology to be securely grounded in engaging, meaningful, and relational pedagogy, and for teachers to become learners alongside their students. They suggest strongly the need to keep pace with the burgeoning, technological metamorphoses, develop creative problem-solving abilities in learners, and equip them for the digital world they will encounter.

Using Technology in a Classroom With Early Learners

McGlynn-Stewart, **Brathwaite**, **Hobman**, **Maguire**, **Mogyordodi**, and **Park** report on the first two years of a three-year study examining the use of open-ended iPad apps to support young children's literacy (visual, oral, print, and digital) learning in 14 full-day Kindergarten classes in Ontario. They argue that these children, ages three to six, who were either English Second Language learners, or those with special learning needs, typically were not easy to assess. Based on interviews with 27 and 25 teachers in the first and second year, they show, with interesting examples, how the use of iPad apps allowed the children to use different modalities to communicate, to record privately, listen and reflect, redo or erase, and to share communicative abilities that were unknown to the teachers. Children were able to link their home language to school and shy children became willing to share iPad creations in group time. All children were engaged, were able to produce complex literacy products, and developed digital competencies while providing teachers with an increased understanding of their interests and abilities.

Using Technology in Upper Elementary and Secondary Classrooms

More than half of the articles for this issue focused on teaching and learning with technology in late elementary and secondary classrooms. In the first of these, **Kuhn** used a technology-supported, student-oriented curriculum to engage middle and high school students. The task was to create an electronic debate with their peers on contemporary social and socio-scientific problems to emphasize present-day and future issues, instead of simply historical ones. They began by discussing challenging topics in face-to-face interaction with "same-side" peers. Then they conducted electronic dialogues with same-side pairs and a series of opposing pairs. Here they practiced argumentative writing which resulted in a final position piece. Kuhn concludes that the argumentative writing enhances conventional essay writing and that the paired work creates an important support system and encourages reflection among peers. **Gimranova**, **Nurmanova**, and **CohenMiller** used what they call Near Peer Role Modeling (NPRM) to promote discussions using WhatsApp texting groups between seventh and eighth grade students learning Kazakh (an official language of Kazakhstan) and university student volunteers. The students enjoyed the project, were motivated to continue this interaction, and had the opportunity to practice Kazakh. An unexpected outcome was the capacity building that went on between the teachers and the university, which augurs well for future work. Challenges included the time required by the teachers to implement the work and the inconsistent access to needed high-speed technology

which was available to the students. **Bengezen** and **Murphy** describe how, over a period of three years, a Brazilian teacher engaged with two of her grade six English Second Language students using Edmodo, a free, communication, collaboration, and coaching platform available to K-12 schools and teachers. She sought to understand more fully who the participants were and were becoming as they focused on authorship using this digital technology. Unsurprisingly, these writing spaces did not only help the students in terms of their writing and technology skills, but also helped the teacher think more specifically about their individual needs and to relinquish her authority with them. **Hughes** and **Maas** share how they worked with a small group of marginalized grade six, seven, and eight students using Aurasma, an augmented reality (AR) platform, to produce a professional-looking, recipe cookbook in a life skills class. AR helped the students develop digital literacy skills, creative/critical thinking, and problem-solving, and collaborative and self-directed learning competencies. The authors underscore the potential for AR in both life skills and nutrition curricula, as well as across other curricular areas. **Cutumisu**, **Labonté**, **Oslie**, **Gange**, **Brown**, and **Smith** implemented a study with five teachers who received professional development and then taught persuasive writing units in their upper elementary classrooms using technology. Students submitted work on devices (laptops, iPads, etc.) and received feedback from university students who acted as writing tutors using Google Docs for their feedback. Their results indicated that blended technology, feedback, and persuasive writing pedagogy were useful and enjoyable for both teachers and students in spite of some technology challenges. Similar to the McGlynn-Stewart et al. article discussed above, teachers were able to connect more fully with their students and get a deeper understanding of their strengths and needs. **Mandinach** and **Miskell** conducted a mixed-methods study which included interviews of teachers and other stakeholders, as well as observations, to explore the use of blended learning in 15 classrooms in three charter schools (two high schools and one middle school) serving students with educational challenges. The learning was blended using many different ways and forms of technology as these schools had an abundance of technology. The results indicated that the students were more active, engaged, motivated, and involved in their own learning. The technologies provided more diverse forms of data that were available to students, as well as to teachers and administrators, which, in turn, permitted flexible and quick adaptations in subsequent face-to-face and virtual learning to meet the students' needs. The authors posit that blended learning environments have the potential to reach and help even the most challenged students to succeed. **Carpenter** and **Justice** conducted a mixed-methods study of largely middle-school classes involved in the Global Read Aloud project developed by Pernille Ripp. Ripp's digital site connects classrooms which read the same books during a two-month period in the fall semester. Teachers connect with Ripp to choose one of the book titles featured on her site and then post an invitation to connect with other classrooms across the globe. They use various means such as Facebook, Twitter, Skype, Edmodo, Padlets, and so forth, to share their thoughts about what they are reading. The idea is to promote global readiness/awareness among students by learning with others in diverse contexts. The authors' survey of 516 participants from 14 countries revealed that the project motivated students particularly when they connected visually, and the various modes of exchange expanded their listening, speaking, reading, and writing experiences, although it was unclear if critical literacy skills were enhanced. The use of asynchronous digital modes mitigated some of the challenges and limitations associated with time differences, but often local pedagogical demands and practices reduced the possibilities of curricular integration.

Using Technology in Higher Education

Russell describes her qualitative study in which she used a wiki social media site with a group of undergraduate childhood studies students as well as her PhD student. The PhD student was assisting Russell in the course to gain teaching experience in order to be competitive in the higher education job market. Positing that a wiki can act as site of "situated learning" and a "community of practice" because of its constitutive and collaborative nature, she interviewed student focus groups and the PhD student about their experiences. Her results showed that there were different levels of participation in the wiki context, but some students gained confidence to voice opinions and increased experience in their writing. The PhD student gained experience and confidence in higher education pedagogy. **Hagerman** and **Coleman** reflect on the use of a Digital Hub strategy with Bachelor of Education students where they each created a digital website, curated their evidence of learning, and reflected on their growth as teachers. They share an example of one student who indicated the hub created an authentic space for identity construction, technical skill development, and digital literacies learning. They intend to explore these avenues in future research. **Carpenter**, **Cook**, **Morrison**, and **Sams** studied the use of Twitter as an outreach, social media tool to enhance course content and extend the classroom context with preservice teachers. The students reached out to the National Council of Teachers of English, a large professional association in the United States, and were surprised to find they could dialogue digitally with responsive and enthusiastic educators. As a result, the students deepened their engagement with course materials, widened their professional conversations/networks and, for some, enhanced their perception of themselves as teachers. Some of the challenges included the disconnect between personal fluency and professional know-how, the perception that Twitter is outdated, the difficulty of integrating Twitter into course content and useful professional development, and the evaluation of Twitter participation. Finally, **Roulston**, **deMarrais**, and **Paulus** conducted a narrative study of the journeys of three faculty members into online teaching of qualitative research methods for graduate students. These narratives provide helpful insights about online course design, planning, and strategies for building community as well as the challenges of keeping up with and learning the technologies, and finding the necessary resources and time needed for course development.

Turning Experiential Learning With Technology Into Maker Experiences

> There are essential elements of educating young people to become innovators: the value of hands-on projects where students have to solve a real world problem and demonstrate mastery; the importance of learning to draw on academic content from multiple disciplines to solve a problem; learning to work in teams. (Wagner & Compton, 2012, p. 52)

Last, but certainly not least, **Davidson** and **Price** argue that technology is not the key component of the fast-growing, makerspace movement where people/students "engage in self-directed experiential learning through risk tolerant, persistent problem-solving in interdependent communities tackling socially relevant problems." Therefore, to understand educational makerspaces, these researchers focused instead on the competencies that can be developed. They recruited 100 people from schools, colleges, universities, and community centres for a series of maker events in the form of experiential learning with technology in a participatory-driven, qualitative study. They define and describe

the key competencies (initiative; playful learning; authentic adaptation; interdependence; and over-resourcing) that emerged in their research and suggest that these characteristics of maker activities can be used as prompts when creating, observing, and evaluating learning experiences.

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Lynn Butler-Kisber (B. Ed., M. Ed., McGill University; Ed. D., Harvard University), a former elementary school teacher, is Professor in the Department of Integrated Studies in Education in the Faculty of Education at McGill. She has held a number of administrative posts including a deanship, two associate deanships, and five directorships, and has served on numerous committees within the University and in the educational milieu. In 2007, she was appointed and continues as Outside Educator to the Board of Directors of St. George's School and she also serves on the board of Explorations Camp. Her interests, teaching, and graduate supervision focus on multiliteracies, leadership, student engagement, professional development, and qualitative research. She has a particular interest in feminist/equity and social justice issues, and the role of arts-based analysis and representation in qualitative research. Her research and development activities have included numerous international projects and locally she is currently working on the LEARN English Language Arts Project, the EDCAN Network Education Fact Sheet Project, and the NEXTSchool Project. In the upcoming year, she will be a visiting scholar at universities in Alberta, Vermont, and Worcester (UK) with a particular focus on arts-based research. She has published and presented extensively in her areas of interest and the second edition of *Qualitative Inquiry: Thematic, Narrative and Arts-Based Perspectives* is being published by Sage.

Putting the Focus on Children as Deliverers of New Technologies

Anne Bamford

Abstract

In this interview, professor and researcher Anne Bamford describes how she initially became interested in virtual learning via cyberbullying, particularly how image manipulation affects young people's perceptions. Next, she discusses her European-wide study on "active 3D" in the classroom, which showed that the more control children took for their own learning, the better the results were. She argues that student involvement and engagement in implementing new technologies is critical for successful virtual learning in schools. Finally, she urges educators to "use the technology where it's going to have the most impact" and not to "put it just for the sake of putting it in the curriculum."

You've been studying the uses of virtual learning environments for a long time, can you explain how you first got involved in this area and why?

My first foray into the area of virtual worlds was via some research I did into cyberbullying. I was interested in how teenagers' perceptions were being changed by their interactions in an online environment. I was particularly focused on the way in which image manipulation causes young people to see their identities quite differently. One thing led to another because what happened was that to be able to do the research that I wanted to do around cyberbullying and the impact of image manipulation on young people's perceptions, I wanted to be able to have access to the Photoshop software, which at the time was only a professional-level software—it wasn't available for general classroom usage. I wanted to see whether young people's perceptions would change when they had the opportunity to manipulate their own images and could understand what was happening in a virtual environment. That really led me on to using that software and using that software with young people. There is a quite funny story really in terms of that because when I first approached Adobe to be able to have the permissions to use it, they said: "Well, it's not going to be relevant at all to education … young people won't know how to use it … it's a professional-level software." And, of course, within an hour, the young people could not only use it, but they could do all these things that the company hadn't even imagined were possible. But the long and the short of that is that resulted in a lot of research I did around visual literacy, which led me into the virtual learning world, but it was very much based on how visual learning affects us both emotionally as learners, but also obviously in terms of the educational impact on learning.

In 2011, you did a large study of 3D learning and its impact on pupils' learning across seven European countries. Can you describe this study and its findings?

It was actually across 10 countries, but we reported it across seven countries because in three of the countries it was done internally—it wasn't externally verified. Basically, it was looking at what is the impact of "active 3D," which is a type of 3D where the image "comes out" at the child, as opposed to

3D which exists within a screen—it was active 3D using 3D glasses. The study was across volunteer classes; the teachers volunteered to be part of this study. But apart from that, the schools weren't selected on the basis of whether they were very technical or not. It was simply on those schools that wanted to be part of this study, and it was a traditional control-group based study. It was all working in the science area. The theme was on "My Body" or "The Human Body," and it was mainly done with pupils aged between 10 and 14. The reason we chose that topic was because it was a topic that all schools, regardless of language, study that topic, roughly about that time, so it felt relevant across cultural boundaries. The study was a traditional study in that the participants were all pre-tested, then they were post-tested after six to eight weeks of the unit involving the 3D. The school had to have one class that used the 3D and another class that didn't use the 3D, but had everything else the same—obviously, they didn't have the teacher the same—in other respects, they had the same situation. We researched the group across time and really looked at the impact on a range of different things: attention span, test scores, learning, communication in the classroom, talking in the classroom, and so on.

As you look back since then, what would you suggest are the most important ingredients for successful virtual learning in schools, and why?

The results of that study were quite interesting because the results showed that, not only did children achieve better test scores, but their percentage of improvement was much higher. Surprisingly, in the control groups: only just over 50% of the children improved at all. And that's quite worrying if you think of eight weeks of learning and very little improvement. I suppose there is a general point for education about the importance of pre-testing children because I think that had we not pre-tested, we may have assumed quite different things. I think the use of pre-testing is a more general conclusion for education. But in terms of the specifics around what works with the introduction of technology, I think one of the key ingredients is engagement of the children or the pupils in the implementation of the technology because teachers struggle to have the time—and also the confidence or the perception of confidence—to often launch into new technologies.

We found that the children very quickly took control of running the 3D learning. In fact, the more the children took control, the better the results were in the school; it was actually the overriding findings. For instance, in one of the Italian schools, there was very limited technical ability and very limited technical resources in the school. For example, the school didn't have Internet that was reliable enough to use in an educational context. So, their success was greater, if not more so, than some of the other schools were there was a lot higher levels of technical proficiency because the children took control of it. And in the children's hands, they were very adventurous and used it a lot. I think a very strong finding was when we implement new technology in an educational context, we need to focus much more on children being the deliverers of the new technology—and not the teachers. The teachers certainly did a lot of work around mediating the content and making the lessons interesting, but we didn't rely on the teachers to actually deliver the technology. And that seemed to have a considerable benefit. The research showed the value of pre-testing and post-testing children so you can really measure change, but the overarching conclusion for education and the implementation of technology was "give it to the kids"—don't "give it to the teachers."

Initially, when I began that study, I was quite concerned that it would have a negative effect on the children's communication in the classroom. In other words, they put on the 3D glasses and it would cause them to not communicate, and that would stifle learning. In fact, we found a really interesting thing: that as soon as they put the 3D glasses on, they communicated even more. And then after the 3D experience, they continued to communicate even more! Contrary to my belief, and what people had said around technology perhaps limiting classroom communication, it really boosted classroom communication. The effect of it lasted a long time after the technology stopped. You could take off the glasses and turn off the 3D, and the level of on-task communication continued to increase. It sort of had a flow-on effect, which was a surprising ending.

Do you have an idea why that happens?

My view was the children became more on-task, and also that the experience was so vivid that, even despite themselves, they found themselves asking questions and being interested. Remember, I said they were 10- to 14-year-olds … so there is that general thing amongst teenagers to not ask questions and to be a bit cool … it seems that the experience was so strong, it broke through that. The other aspect to it which was particular to the 3D, is when you were using active 3D, it was impossible for the teacher to stand at the front of the room, because otherwise the teacher didn't see it. The teacher had to position him or herself amongst the pupils and I think that physical movement of the teacher also changed the dynamics of the classroom, which meant more questions were asked as well. A combination of the excitement of the experience dragged the children in even if they were trying to "be cool" and also that when the teacher moved themselves into the position with the children, the dynamics in the classroom changed, which also meant that there was a different flow of conversation. I was surprised it continued to increase … so it sort of stimulated it.

Where do you think virtual learning is heading in the future? What platforms are the best?

I think there's a lot of potential for virtual learning that's not been effectively mined. We have a huge capacity to do a lot more than we do—particularly in the British context where I am at the moment—there's a huge potential for virtual learning where we have shortages of qualified teachers. We're desperately short of teachers in London and I think that that's an opportunity. There's also an opportunity to bring to young people a breadth of topics and subjects and expertise that we couldn't otherwise do—and also do things that we couldn't otherwise do. For example, in the virtual world, kids can split atoms and all of these things that they can't ever do in the realities of the classroom. While I don't think it's a substitute for classroom experiences, it's a very powerful adjunct.

There is a lot more capacity for global learning. One of the interesting findings from that European study was that many of the teachers who met virtually through the process of being participants in the research have continued on that meeting, that sharing of resources, and the sharing of information. I think that would become a really valuable thing, so we become less centered on just our school and just our country, and we're more proactive in an international sense. In countries where there's a lack of teacher training and teacher education, it could be used to also develop the workforce and develop knowledge in the workforce.

If you were designing a school from scratch, what would you do to make certain that successful virtual learning is an integral part of the curriculum?

Interesting you ask that question because I was asked a question sort of similar in an interview relatively recently and they asked me, "What do you think the school of the future might look like?" And in that I feel, "perhaps there won't be a school at all," and they said, "What piece of technology might lead to the most change?" And I said, "perhaps the Google self-driving cars would" because I could put the pupils in cars that would then drive off to museums and galleries and concerts, and so on to see the world. I don't really know, but I think that it's got to be a collaborative space, so the design of the school, if you're going to have a physical school, has to maximize the opportunity for collaboration between subjects, between staff, and between pupils. It has to be based much more on pupil-led learning than we've currently got. The role of the teacher is going to change significantly in the future, and I don't think the current models of teacher education adequately prepare people for this quite different role. The role of the teacher will be still important and probably even more important, and it will be a much higher-level role because it will require much more critical and reflective thinking on behalf of the teacher. But I don't think we're adequately preparing teachers for the future. We need quite different competencies in the competencies we've got.

In terms of a physical or virtual environment, I would like to see content much more freely accessible to people. Content is still quite expensive to schools. Also, we have to have much more plug-in-and-go technology. Obviously, the Cloud is part-way to that because we can't be dependent on continually updating hard resources—because that's just too expensive for most education systems. It has to be something that's delivered, like electricity or gas, that's just there, and we sort of plug in and go. I think that that will be the future and I think we have to stop having technologies that imitate old ways of working. For example, I'm not a great fan of the electronic white board—and I know that upsets some people when I say it—but it's because I think it reinforces a way of teaching that wasn't a very effective way of teaching and learning. We have to not just use technology to sort of replicate an existing system, we have to think what can technology do better. And, perhaps as I've said, it might a self-driving car … you can put the children in it and send them off to the museum to learn … that might be a great revolution because the cost of buses prevents people from going to the museum. It's about thinking outside the box on how to use technology in the classroom.

What advice do you have for teachers and school leaders embarking on virtual learning?

I've probably hinted at it already, but the first one I would say is: "get your children involved—get the young people involved" because the so-called "digital natives" are better than we are at using this in a very intuitive way. That would be the first thing I suggest is make sure that you straight away give it across to the young people to see what they can do with it. The other thing teachers need to do is think about assessment because you need quite different models of assessment. I'm a big fan of tracking children's learning and pre-testing as we really need to know what children know before we begin to teach and also how our teaching changes what a child knows or can do.

If we're not very careful—we've all done it ourselves when we're searching on the Web or something—you can spend several hours, and you haven't really achieved much at the end of it. It hasn't really had a big impact on your learning … it hasn't changed the way you think … it hasn't been critical … it's not very high level. As we look at new forms of learning and the use of technology, we have to make sure our assessment and evaluation tools are up to the job because they have to be able to see that we're really learning. You can't have children wasting time and not actually learning. How do we know … if doing 3D or whatever … for 10 minutes or half an hour … how has that really changed the way they learn and do we have the tools in place to be able to track their learning?

There is some interesting research out at the moment … changes in neuroscience, in data tracking, in rich data—those sort of things might give us a key, but I think we need to develop better tools. The teachers embarking on this need to be thinking about "assessment" right from the very start. What are we trying to learn? How will we know if the children are learning it? And to be honest, if they can learn it better with a pencil and paper, then give them a pencil and paper! Use the technology where it's going to have the most impact. Don't put it just for the sake of putting it in the curriculum, which is sometimes what you see.

Do you think professional development is necessary for teachers embarking on this kind of project?

That's a really interesting question because based on the findings of the research that I've done, I'm looking at that quite differently. We've recently conducted some research with Microsoft where, quite deliberately, we invited the children to professional development and we said to the teachers, "Sit over there at the table. There are some laptops if you want to do it, but basically relax. Have a coffee, enjoy some nice food. We don't care if you don't do anything today if you just relax." It was interesting because the teachers became much more interested and were going to the children to try and learn the work. I think flipping the focus around, perhaps too much emphasis is being placed on professional development of teachers, and insufficient effort being placed on the development of children to lead learning. I'm trying to flip it round the other way in creating children as learning ambassadors and saying to the teachers: "You work really hard. Just relax. Have a coffee. Chill." And it actually has a reverse psychology thing that they become really interested in wanting to learn. They're sort of fighting to learn, rather than being disenfranchised, sitting in the back of some professional development session, not really caring what goes on. I'm turning it around a little bit—I'm not quite sure of my answer to that one yet.

Can you describe something you saw that was very interesting when children take charge of their learning?

I want to give an example from Italy because it was quite moving when it actually happened. The children were from a "Roma" community. Traditionally, they're referred to as a "gypsy" community. The pupils were in a quite deprived area in Rome and the teacher was absolutely amazed because one of the Roma boys had gone home after seeing the 3D heart, which was pumping and beating in front of him. He'd gone home and out of a plastic drink bottle and some straws and things, he'd created his own model of the heart and then he brought it into school the next day and was explaining to the children how it worked. The teacher was just absolutely amazed because she said, "He's never really engaged in

anything. And not only is he engaged in it, but he's gone with his quite limited resources and created this, and then been willing to share it back into the classroom." I think that's incredibly powerful as a way. We also had children in Sweden, which when it was lunch time, they didn't want to stop. In Greece, the children themselves were developing their own 3D content … they were starting to use 3D cameras. When you leave it with them, they do so much more than your ambition that you could have set for the program … when they get enthusiastic about something and when you give them ownership of it.

Do you have any other comments that you would like to add?

I think the key things are in teacher education for the future, around assessment and evaluation and how we get much smarter in what we do there. I think it is about the role of the teacher changing and giving ownership to the children; and if you don't, you're always going to be behind the development of things. You have to think quite differently than we currently do.

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The Challenges of Using Integrated Technology in the Classroom

Kish Gué

Abstract

In this interview, ICT consultant Kish Gué shares his thoughts on how teachers can integrate technology in the classroom. In view of ever-changing technological advances, he believes that teachers should switch to learning at the same time as their students as opposed to teaching them about technology. He provides examples of projects that have successfully integrated technology and gives advice to novice teachers on how to best use technology in their teaching. He explains that parents have an important role in ensuring that their kids become good "digital citizens" who use the Internet safely and responsibly. Finally, he shares what his own daughter has taught him about technology.

You are the "RÉCIT" person from the English Montreal School Board (EMSB). Can you talk about what this involves and how you ended up in this position?

RÉCIT[1] is a network of pedagogues. Their mandate is to promote the integration of technology in the schools. There are different levels of RÉCIT members. There is the local level—that's what I am: someone in charge of sharing all the resources gathered by RÉCIT in their school board. So, there's one for every school board in the province of Quebec. Then we have the national members who are composed of only one person per subject matter for the whole province. They also have the same mandate, but they do it at a provincial level. They work a lot with us and build a lot of resources and websites—interesting pedagogical resources that we can use with teachers and students in our school boards. We also have the FGA,[2] which is "Formation générale des adultes," so you also have RÉCIT in charge of the adult sector as well as one RÉCIT person for all the private schools.

How did I end up being a local RÉCIT? I was actually hired as an information, communications, and technology (ICT) consultant with the board. Someone else has the official RÉCIT title at the EMSB—her name is Caroline Dupuis. But she was on loan from the Ministry and I ended up replacing her for the last four years. She's probably going to come back and I'm going to go back to becoming a regular ICT consultant, but for now I wear both hats.

What did you do before you were doing this?

Before this I was a teacher and started teaching in 1998. I taught in elementary schools at all grade levels and loved it. I started integrating technology very rapidly because I saw the value and potential—the added value to the learning that was happening in the classroom with technologies. And I ended up becoming a consultant. I really started helping out the official consultants at the board that I used to work for, which was Riverside School Board … and a position opened up.

One of your strengths is your ability to work with students on projects. Can you talk about a few projects that stand out and indicate why they were so successful?

There are many projects, especially since I've become a RÉCIT employee. I have access to this wealth of knowledge and resources by other pedagogues that are part of RÉCIT. Being in touch with the national RÉCIT organization, I also have access to every document and resource that they produce. They come up with a lot of good ideas for projects. What I like is that it's always done with the focus on pedagogy— and not on the technology. Technology is a great component, but it's not the end goal: we don't want to make our students people that are good at using computers, but rather people that are more and more proficient at learning whatever they're exposed to.

One big project is called "Culture à l'écoute,"[3] which would translate to "Tune Into Culture." We use the QR code technology[4] and link those QR codes to podcasts that have been created by students. These students go around their community, look at historical and interesting landmarks, research them, and create a 45-second podcast, which really is a 45-second oral presentation. In these podcasts, they work on the language, on the "univers social," which is Social Sciences, and they use the technology. So, they create; they record their voice. I go in there and help the teachers and students understand how to use audio-editing software to create a nice oral audio file accompanied by images that they took themselves. What's great about that project—and many other projects—is that it's very purposeful. When the students do engage in those projects, they don't feel like they're doing work for their teacher—it becomes something real: there is a real audience out there that will benefit from their work. What's also great about that is that it gives them a sense of: "Even if I'm just a child, I have a lot power and can contribute positively to my community. My work can even benefit adults." And that is a great feeling because I feel that it gives them a taste of what they can do later in life. I'm not talking about audio files that are accessible, but in terms of what they can contribute. It's like planting an idea in someone's head: once you have an idea you'll probably end up acting on it. It's like the movie "Inception" with Leonardo DiCaprio: it starts with an idea—and for them it was much more than an idea, it was actually experimenting something that worked.

"Histoire de manga"[5] was another great project. It was a comic strip influenced by the Japanese style. It was another project that was put together by LEARN-RÉCIT. LEARN is pretty much the same as the national RÉCIT, but for the Anglophone community. So, Histoire de manga ("The Story of Mangas"), which are Japanese animes or cartoons, was interesting for students because they thought of a story that they wanted to tell and it's always linked to the subject domains that they're working on. They had to think of a story, storyboard it, went ahead with iPads all around the school, took pictures that would be part of the manga, and then added filters with apps such as Comic Life. They add filters so that it becomes kind of cartoonish. But then we studied how the Japanese do it, the expressions that they have—there is a lot of focus on facial expressions. And all of that is integrated into one beautiful project at the end.

Some teachers feel very vulnerable when trying to use technology. What advice do you have for them?

Over the years, I've come to realize that teachers must have the courage to be vulnerable. It's not a bad thing to be vulnerable. There is a difference between being vulnerable and losing control: we're not

talking about *losing* control, but rather *surrendering* control. I think that many people that went into teaching are people that like to control things, and are pretty good at organizing themselves, organizing their class, and planning. If something fails, they have a Plan B, and if Plan B fails they have a Plan C. When it comes to integrated technology, it's really hard because technology is very efficient, but it's not always reliable. And it does happen that sometimes it just doesn't work and you don't understand why— and you have to be comfortable with that fact. Technology develops so fast that it's impossible to know everything. Just from one version to another version things change. We have to be comfortable with understanding that we can't know everything, but that we can still try to use it, especially with our students. Our students themselves are able to learn and they will adapt. Let's do it with them and try not to learn everything before them, and then present the technology—that just can't happen for the reasons that I've mentioned. It's important to have the courage to just *jump*—and you know that you're going to end up swimming anyways; you're not going to drown.

It does happen that sometimes the whole lesson doesn't work and the technology didn't work, but that's actually also valuable because then you just figure out why it didn't work—and right there you know more. When I was a teacher, that's what I always did. At the beginning of the 2000 year, we got Apple computers that we called the Blue Bundies. They were transparent with colours: blue, green, pink. And with that computer came a software called iMovie. At first, we didn't know what it was, but our principal knew that we could make movies with it and bought two cameras for the school. I had no idea how to use it, but I knew that it would be interesting to use iMovie. So, I kept a few kids with me at lunchtime and we just figured it out, but all together. I don't have enough time to learn a technology by myself and then present it to my students. If I do that, my wife is not going to be too happy with me! That year, as soon as we figured it out, we saw the possibilities. We started doing little documentaries and by the end of the year we had produced a 30-minute movie on Great Civilizations. That was a crucial year for me to realize that we can learn *with* our students, but you have to be able to surrender control. You have to know that you cannot control every aspect of what's going to happen. Talking to many consultants, especially the ones in technology, we realized that we pretty much all shared that characteristic and personality trait: we don't have a problem with welcoming what's new; we just try. We don't try to learn everything in advance—it's not even possible to do.

Do you have any suggestions for a teacher who's a novice with technology on how to get started?

There are a lot of resources out there, especially on the Internet and social media. If you don't know how to do something, someone else does and that someone can easily be found on the Internet either through YouTube videos and online tutorials or through Twitter. There are so many great pedagogues on Twitter sharing what they're doing every day. Two weekends ago I was in New Hampshire with Alan November.[6] He shared what a classroom did on Twitter. Little kids wanted to know how to create robots, but they didn't exactly know how … so they connected to a classroom in Japan and the kids in Japan showed them how to do those robots. Social media is extremely powerful if we use it correctly. So, go on social media and find help online, and if you have someone in your school or someone in your milieu that can help you, do not hesitate to contact that person.

I remember one of the first things that I wanted to learn when I was a teacher was how to have an image and text over the image—that's all I wanted. So, I went to the right person who was able to show that part to me. Once I understood how to do that, then I kept on looking for different interesting things to do. I really started engaging in projects and back there we had created a magazine just with image and text over it. Someone was there to help me, but I went out and looked for that person.

What do you suggest parents need to know about technology in order to keep their children engaged and safe?

Digital citizenship is a big dossier that pretty much all the school boards throughout the world are now looking into. By "digital citizenship," I mean how to use the Internet, not only in a safe way, but in a responsible way. The virtual world is very much there. Even if it's virtual, it's very real—and everything that happens on the Internet has an impact on their real physical life. Kids understand how to use the technology pretty well, but it doesn't mean that they use their judgment in the right way all the time. And that's where parents can have a huge impact: they don't need to know everything, but they have to understand how to help their kids make good decisions. Everything that you do in real life, you should act the same also online. The attitudes that we've seen of parents are very often, either they don't want to know anything about the Internet and they prevent their kids from using computers, or they say, "I don't know anything about computers," and they let them do whatever they want. Both attitudes I find are problematic. If you're way too restrictive, it doesn't mean that the student won't be exposed to the technology once they leave the household. And if you are too permissive, then we end up with the problems that we've had for the last few years. We have a whole generation of students that raised themselves with technology and on the Internet … cyberbullying … we see the problems. Parents, first of all, have to understand that computers and the Internet are very powerful, but they can be used in a very positive way … what we call the "online reputation." It's hard to not be present on the Internet at all. We always leave traces and some traces are not even your own—it can be someone else that posted something on you. We have to make sure that what people see about us on the Internet reflects positively on us, instead of negatively. So, parents can play a big role.

If you were to design a school of your dreams, how would digital technologies be used in the most effective and efficient ways?

I think that technology has to be transparent. When we use technology, the learning curve must not be too steep in order for the learning to remain the focus of what's happening in the school. Technology can be a big component of what's happening in the classroom, but if we use technology also in a way that it helps out with the logistics of the work being done, that's a very transparent use of technology. Right now, many students still have big school bags. If we could have more e-books or digital books … but the technology is there for that. I'd love to see in schools where kids don't have school bags, and I would love for a principal to have that as an objective and try to see how that would be possible. Kids are still using agendas—why is that when we have the technology that can do even better than using physical agendas? There are a lot of things that have to be rethought. I would love for schools to have technologies that work. One of the reasons why many teachers don't want to use technology is that they

get discouraged very easily when they want to use it and it's not working. I would like teachers to be exposed to what they can do that integrates the technology. Many teachers have no clue—some teachers want to use the technology, but they don't know what to do: they don't get it. How can we help them much more than what we're doing right now? I would love the schools to have a different structure in terms of how the day is organized. We have all those 50- and 60-minute periods—can we change all of that? Can we break … even physical walls … something major has to be done with schools. The schools that we have still reflect the philosophy of another era. It's not at all linked to the learning that should be happening in schools. There is a lot of work done in flexible learning spaces lately and it's not about having a cool class that looks good—it's about removing obstacles to the kind of learning that we want to see happening in the schools today. Even the way technology is used or placed—where it is in the schools—sometimes is problematic. What are we still doing with computer labs? It's better to have a computer lab than not have any, but it would be great if we had a variety of access to technology. If there could be more computers, tablets, and Chromebooks in the classrooms, it would help so much more because the students would be able to use technology when they need it, not Friday, Period 5.

You have a daughter who is eight who came to an education camp recently. What do you know about technology integration because of having a daughter that you might not otherwise know?

Because of my daughter I know about what appeals to kids. Especially with social media and YouTube videos, she's always asking me when we're at Rona, Walmart, or whenever we're at a store, "Oh, can you buy this or can you buy that?" because of something that she saw on the Internet. And it's very often beautiful: she comes up with those great ideas triggered by videos that she's watched, but there's a whole world of YouTubers that are extremely powerful in terms of reach throughout the planet. You look at their videos and they have four, five, or 10 million views … people all over the world are watching what these people are doing … it's a testimonial to how powerful social media is. I'm glad because she loves DIY videos—that's all she pretty much does when she's on YouTube. But it's a very positive relationship with social media because it translates into things that she can do in real life. I was surprised—and speaking to other parents that have kids the same age—it's the same for their kids as well. They all know the same people on the Internet and they use the same craft techniques.

Slime[7] right now is huge: how to make slime and there are so many different techniques. My daughter just goes on the Internet and looks for those resources. I am surprised to see how powerful social media is for students. I am happy to see that in her class they're using a few technologies that I've been showing to teachers. The other day my daughter came home and she wanted to do a Kahoot,[8] which is a student-response system where you see a question that appears and you have to answer with some kind of technology. If I wasn't in the domain I wouldn't know about that. Because I'm in the field I pretty much know already what she's going to show me, but I can imagine that many parents would be very surprised by what their kids are showing them that exists out there.

Notes

1. RÉCIT stands for Réseau • Éducation • Collaboration • Innovation • Technologie.
   For more information: http://www.recit.qc.ca
   http://www.learnquebec.ca/the-recit-network
   https://www.youtube.com/watch?v=1QLevM3xgjg&t=6s

2. For more information: http://www.education.gouv.qc.ca/adultes/formation-generale-des-adultes/

3. For more information: http://www.recitus.qc.ca/nouvelles/audioguides

4. For more information: https://en.wikipedia.org/wiki/QR_code
   Examples of scanning QR codes: http://bit.ly/2AmsivA

5. For more information: http://recitdesarts.wixsite.com/histoiremanga
   View examples: https://drive.google.com/open?id=1sF4HebrAI0D78fOE6-0mHv0EJAA8KIsO

6. For more information: http://novemberlearning.com/educational-services/educational-consultants/alan-november/

7. For more information: https://www.highsnobiety.com/2017/06/15/slime-trend/

8. For more information: https://kahoot.com/

Kish Gué has worked in the education sector for over 19 years. He spent a large part of his career teaching at the elementary level and also has taught in high schools and adult education programs. For the last seven years, Kish has been supporting teachers as an Information and Communication Technology Pedagogical Consultant for the English Montreal School Board. Kish gives conferences and workshops on a regular basis and enjoys spending time with teachers and students in the classroom. He is passionate about promoting the pedagogically grounded integration of technology.

An Exploration of Artistic and Technological Symmetry

Artemis Papert

Abstract

In this interview, biologist, artist, and shiatsu healer Artemis Papert describes how computational thinking can help people organize their thoughts in a more formal way. She discusses TurtleArt, a software that allows both children and adults to create two-dimensional static art images using geometry and coding as a medium. TurtleArt not only bridges the worlds of math and art, but is also easy to learn. She concludes by reading an excerpt from the article, "Teaching Children Thinking"—written in 1971 by her father Seymour Papert—as a still relevant starting point for where technology is heading.

You're known as an artist and a healer, can you tell us how your career unfolded and how these two areas of talent emerged?

I've always liked drawing and painting since ever I can remember. I might have gone to art school had I been born in a different family, but I was born in a family of academics. So, it felt like academia was the thing to do. My mother worked with Jean Piaget and my father was a mathematician who also came to work with Jean Piaget because Piaget wanted to understand how children understand numbers. And he thought it would be a good thing to have mathematicians in his team—so that's how my parents met and how I came along. I always wanted to become a biologist. Back then, I was young and naïve and wanted to save the Antarctica, and the Rain Forest … My career as a biologist didn't quite evolve as I had hoped it would. I did my master's degree and PhD in biology and had a fewpost-doctoral positions. However, my career was heading more and more towards molecular ecology, rather than ecological research dealing with whole organisms.

While I was working in biology I was thinking, "It would be nice to expand and also do something else." I was living in Scotland at the time and discovered shiatsu, which is "acupuncture without needles" and also based on Traditional Chinese Medicine. The more I was doing shiatsu, the more I was getting enthusiastic about it and more and more drawn into it, to the point where I decided to do shiatsu and stop doing biology. Of course, in shiatsu you deal with human bodies, deal with human beings—deal with the whole organism. So that's back to me wanting to be an ecologist—I'm not dealing with the ecosystem of the rainforest or the Antarctica, but I'm dealing with the ecosystem of the human body.

Shiatsu is a healing art; there is an art in there. Yes, of course you need to know your theory, you need to know what you're doing, but with every person, in every session, it's different. The Dutch artist Vincent van Gogh said, "You need to know your technique so well that you can forget it." And it's the same thing with shiatsu. After my first few hours of shiatsu classes I was thinking: "What do I do? Where do I press? What's happening here and there?" And after a while you just do it because you don't think about it. You take a paper and pencil and you write something—you don't think, "I'm holding a pencil in my hand

and this is a sheet of paper"—you just write. It's the same with art after a while: you don't think about the medium you're using—it's just a medium. You just think about the creation you are creating or the healing you are giving.

There is a growing emphasis and a need to develop computer programming skills among students in elementary and high schools. What are your thoughts on this?

Computers are a very powerful tool if used in the proper way. They can be used as a substitute for television or as a tool to help you think. The big word these days is "computational thinking," which nobody has quite described very precisely. One definition of computational thinking that I quite like is from Stephen Wolfram (2016), who said, "It's a way of expressing yourself in a way that a computer will understand." And it's using "algorithms," which is also a big word and a way of theoretically saying something. It's a way to learn some thinking skills and organize your thinking in a more formal way.

An important thing when you program is debugging. You write a program and ask yourself: "Did it do what I wanted it to do?" If yes, good. If not, "How do I fix it so that it can be doing what I want it to do?" It's also a way of learning skills that you can apply to life. Things in life don't always go as expected, so what do you do? How do you "debug" them?

The other question about computer and programming skills is: Why are we teaching that to children? Yes, it's an important skill to have, but why? It's important to understand what you can do with a computer because it allows you to do some very powerful projects and things that you would not otherwise be able to do as easily—or not all maybe, depending on what it is. It's not necessarily to become a professional programmer; it's not a trade skill. Some people will become professional programmers later in life, but that's not the goal—or that should not be the only goal. A little bit of programming goes a long way.

TurtleArt lets you make images with your computer. The Turtle follows a sequence of commands. You specify the sequence by snapping together puzzle like blocks. The blocks can tell the turtle to draw lines and arcs, draw in different colors, go to a specific place on the screen, etc. There are also blocks that let you repeat or name sequences. Other blocks perform logical operations.

The sequence of blocks as a program that describes an image. This kind of programming is inspired by the LOGO programming language. It was designed to be easy enough for children and yet powerful enough for people of all ages. TurtleArt is focused on making images while allowing you to explore geometry and programming.

Fig. 1: Description of TurtleArt (Source: https://turtleart.org/)

TurtleArt was developed by your partner Brian Silverman and his work partner Paula Bontá. It has encouraged in many settings around the world constructionist beliefs about learning—actually initiated by your father, Seymour Papert. Can you talk about what TurtleArt is and the potential it has for use across subject areas and with all levels of students?

TurtleArt is based on the Logo programming language co-invented by my father and his colleagues Cynthia Solomon and Wally Feurzeig. That was in the 60s, early 70s. The idea was to have a

programming language that was easy enough for even very young children to use and powerful enough that even a professional programmer could use. The idea behind TurtleArt was to go back to Turtle Geometry and do one thing and do it well. It's about making two-dimensional static art images using geometry, using coding as a medium. It's a very simple programming language. The vocabulary is only 50 words. You go very quickly from learning it to learning with it.

After that, there is the artistic expression, which takes hours and hours and is an artistic exploration. And finding your voice takes the time it will take. It's about how you express your voice with this specific medium you have. Because it's using code as a medium, the people that are more math oriented will do some artwork, but they think they're doing math and programming. While the people that are art oriented are doing art, but in the process they do some programming. It's a way of getting both coming together. One thing that Seymour said in his book, "Mindstorms" (1980), is that there is this language-oriented/math-oriented dichotomy. And it's an artificial dichotomy. Yes, some things come more easily to some people, some people pick up languages more easily, some people get theoretical mathematical concepts more easily, but it doesn't mean that because you're good at English you're necessarily going to be stupid in programming and math—or vice versa.

One image that my father was using was the image of "Mathland." He said, "Someone who is born in a French-speaking family will speak French." There is no story like: "Oh, I'm not good at French." If you are born in an English-speaking family, you speak English. There is no question: "I'm not good at languages; I'm not good at English." Everybody will speak the language of the family they are born into. Seymour said for math: "Why don't we have a place where you learn math because everybody speaks math. That's the language that's spoken." So, that's how the idea of the Logo programming language came in. And TurtleArt could be a subset of Mathland—it is a Mathland for the people from "Artland." You could get into art by using TurtleArt without thinking you are doing art. Or you can be into doing art using coding without thinking you are doing coding.

One way where TurtleArt will fit with all levels of students is that it's simple enough that younger children can use it. And it's powerful enough also that adults can use it. In the classroom, it's a good way of getting the art teacher and the math teacher to collaborate on some projects.

What have you found are the most appealing aspects of TurtleArt to novice students? Can you give a couple of examples that you've witnessed?

One of the exciting things about TurtleArt is you can get started very easily and get a result in the first 15 minutes. You are probably not going to get the most amazing piece of artwork. There are exceptions, of course, but it will take maybe a few hours before you have something artistically really interesting. A first result happening quickly can be encouraging for children. In art, there's nothing that's right or wrong—it's about your own personal taste: "Do I like it or not?"

Fig. 2: Sea Moon, image made with TurtleArt – Designed by Artemis Papert

What kinds of suggestions do you give to teachers who want to introduce and become involved in TurtleArt in their classrooms?

First thing: get the software at www.turtleart.org (click on "email us" and request a download link) or at the App Store if you have an iPad. Then play with it yourself. One thing that Seymour said is: "Children learn best by doing personally meaningful projects." Of course, it's the case for adults too. If you want your students in your classroom to get excited about something, but you find the thing boring, how much of a chance of success do you have there? My guess would be "not impossible," but "not a lot." If you tell your students, "Look, I discovered this great thing that I'm really excited about! Let's play with it together." Then the chance of getting more kids involved is going to be better. Don't be afraid of not knowing everything—it's okay to discover with your students. Be a few steps ahead of them, but you don't need to know everything. It's important also for students to see that the adult doesn't know everything. It's a way of showing them how you discover things, how you learn things.

In the best of all worlds, where do you think digital technologies are headed and what advice do you have for educators?

To answer that question, I want to go back to something that was written in 1971 by Seymour, entitled "Teaching Children Thinking":

> The phrase "technology and education" usually means inventing new gadgets to teach the same old stuff in a thinly disguised version of the same old way. Moreover, if the gadgets are computers, the same old teaching becomes incredibly more expensive and biased towards its dullest parts, namely the kind of rote learning in which measurable results can be obtained by treating the children like pigeons in a Skinner box.

> The purpose of this essay is to present a grander vision of an educational system in which technology is used not in the form of machines for processing children but as something the child himself will learn to manipulate, to extend, to apply to projects, thereby gaining a greater and

> more articulate mastery of the world, a sense of the power of applied knowledge and a self-confidently realistic image of himself as an intellectual agent. Stated more simply, I believe with Dewey, Montessori, and Piaget that children learn by doing and by thinking about what they do. And so the fundamental ingredients of educational innovation must be better things to do and better ways to think about oneself doing these things.
>
> I claim that computation is by far the richest known source of these ingredients. We can give children unprecedented power to invent and carry out exciting projects by providing them with access to computers … (Papert, 1971)

In 1971, the idea of a child using a computer was like science fiction. There were no laptops, iPads, or smartphones. It was like: "What do you mean a child can use a computer?" Now, every child has some electronic device of some kind or another. And how is that empowering them? If you use them as a babysitter and have your two-year-old just watching YouTube videos all the time, it's not going to help his or her intellectual development. If you are using the electronic device to help the child do something creative, and think about what they are doing, then it will help intellectually. Programming is a very powerful activity because there is no way of doing coding without thinking about: "What do I want the computer to do?"

Alan Kay said, "The best way to predict the future is to invent it." If we want computers not to be used only to do in a more expensive way the same old stuff, then one thing to invent is ways that allow to use computers in a more intellectually engaging way. You need to have the tools that will allow you to get engaged. There are people who invented tools that allow you to go deeper and think deeper about what you're doing. A lot of the software you see out there for the apps for your phone, for your iPad, whatever device you have, is just doing the same old things just using a new more expensive technology. I hope that the pendulum will swing back at one point to making more applications available, which people of all ages, not only children, will be able to use while getting more intellectually involved.

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Instilling Joy in a Digital Age

Dean Shareski

Abstract

In this interview, digital consultant and author Dean Shareski talks about the fundamental aspects of authentic learning: joy, wonder, play, and community. He believes that technology can bring a sense of fun and curiosity to the classroom by allowing students to do things they couldn't do before, like editing photographs or meeting a scientist from another part of the world. School communities can now share their innovations with the community at large and also with schools in different countries. Teachers, he says, should see themselves as artists and not be afraid to play and explore new opportunities. As final advice to teachers and parents, he suggests that we let kids be kids and experience the joy of childhood.

Can you tell us about how you became a digital learning consultant?

Probably about the mid-90s, technology started becoming more and more prevalent in schools and as a classroom teacher I was certainly really curious and interested in that. Our school had a professional development day and they were asking people to share about new things. It was the first time I had a digital camera and I thought this was really interesting and thought about the possibilities. I remember doing one of the very first adult workshops that I'd ever done and it really pushed me down a path. I got some good feedback around that, but also my own curiosity around what can digital do for teaching and learning. From there I was given some opportunities which were really critical for me to work not only with my classroom, but I also was given a quarter time to work with other teachers supporting technology. There was a lot more incentives from within the district, but also provincially around moving forward with technology. I took advantage of all those opportunities and when a position opened up in our school division, I jumped at it and was fortunate enough to be given that position. That's where I really took on that role of digital consultant in the school division and then from there it continued. That's been obviously a theme in my career moving forward. I was a classroom teacher for 14 years and taught everything in elementary. Just like so many of us, that was sort of my grounding … very much just tied to a classroom and doing the regular things that all teachers do.

In your book, "Embracing a Culture of Joy," you talk about fundamental aspects of all authentic learning comprising joy, wonder, play, and community. Can you tell us about these important dimensions of learning?

I've always felt in some respects as if we've over-complicated learning and education. For me it was an issue of let's get down to what really matters and strip away a lot of … not to say that they weren't important conversations in all kinds of areas. But for me, what is at the core of what it means to be a learner, and in particular, not in and around schools, just learning in general. Those fundamental things,

joy, play, wonder, and community, those aren't specific to school. I think those are generic to a life of learning. I wanted to think about learning beyond just the classroom, but also in the classroom. Those are the elements that resonated with me, and as I've been able to share that idea with others, has been resonating with other people. I'm always very careful to say: "Just because you write a book doesn't make you an expert." I'm not a researcher so I can't produce a load of data for people to examine: are these actually *the* things? I don't proclaim these are the only principles of great learning, but for me they are fundamental and I'm trying to push conversations around those ideas of what that means and how it means to be intentional with those ideas.

How do you define "joy"?

That's a question that, although I wrote about it and speak about it on a regular basis, I'm continually looking for, "What does that mean?" I start with a definition and if you take it right from Webster's it talks about this emotion, "an expression of well-being." And there is an outward expression around that. I refer to moments that in a classroom everybody has experienced: everybody has experienced that moment when the bell rings and nobody moves because you're in the middle of a story—and for that moment there is this joy of, "I'm in the moment. I'm in the right place. This is where I want to be. This is the thing I want to work at." Those are certainly the moments of "eureka" when students are working on a project. The word that is probably most commonly used today is "engagement." That's really what I'm talking about: "I'm doing this for no other reason than I love this and I want to pursue this idea or whatever I'm working on." That's kind of how I define joy and I think it looks like a lot of different things: it might look different in a kindergarten class as it would in other places. It's this intuitive sense of well-being, but also in an outward expressive way.

How important are the aspects of play and wonder?

Play is a really important one. As somebody who taught early elementary, of course it's very easy to see that. Seymour Papert talks about the fact that playfulness is an intellectual pursuit. And that's not something that we typically as older adults have taken, because play has been something that I feel like we do early in life, and then when we figure things out we say, "Okay, enough with the play time, let's get serious about this thing." There are a number of writings … I know Douglas Thomas and John Seely Brown talk about the fact that the world is in such constant change and flux now, that if you aren't someone who is willing to play and explore new opportunities, you're really missing out on a new culture of learning.

When I think about play, it's this willingness to say, "Let's try something new," and not be so tied to the outcome. I think it is paired with reflection, so it's not, "Let's just do something for the sake of it." I think it is tied to, "Let's pull back; let's try this" and say, "How did that work? Did that seem to make a difference? Is there something we can continue to look at?" I think that "wonder" is maybe backing up a step to a sense of noticing things. Ellen Langer, she's written a lot of books on mindfulness, when she talks about mindfulness she's not talking about meditation or any of those other things which are certainly part of that conversation. She's just talking about noticing, and I think that's such an important disposition

to what wonder is … seeing simple things that you hadn't noticed before … everyday kinds of experiences. Wonder isn't necessarily these "wonders of the world" or "huge phenomena" that we typically think of as "wondrous." I think it's in noticing the everyday things. I love the book by Robert Fulghum, "All I Really Need to Know I Learned in Kindergarten" where he talks about the plant and the seed, and you put that little seed in the cup and somehow that thing grows! Every time we see that it should blow us away. Every time we see a sunset or see something happen in nature … that should provoke us to wonder. Again, I think that's where that starts and the playfulness is almost like the acting upon that wonder: "What can we do with that? How can we pursue these wonders that we have?"

You give examples in your book about how digital technologies can engage students in joyful learning and can also be used to showcase joyful learning. Can you describe a few examples?

There is a new app that certainly comes out every day, and not to see that as an exclusive path, but it is one example of, "We can try this new technology that allows us to … even just around photography that allows you to clone something or put yourself in the background and position you in a new light." Those are really playful things, but also, "Wow! We can do something that we couldn't do before!" When I think about technology in particular, that's always a fundamental question for me: "What can we do now that we couldn't do before?" This conversation that we're having right now: that's not something that was really possible 20 or 30 years ago, that you could have a visual connection with another human being.

When I think of technologies that bring joy: bringing a scientist into your classroom to talk about polar bears (we just did that a few weeks ago). You're broadcasting to schools all over the world, talking about the problem we have in Churchill, Manitoba and the impact that that has around the world. Those global kinds of connections, the ways in which we can communicate and share that joy. Because, again, that ties back to the idea of community, we're sharing back to our local community, our parents, but also the world that says, "Hey, we're doing something interesting and maybe somebody else from some other part of the world might find this interesting too and would love to work with us or have us teach you." Those are really opportunities that technology provides us that we didn't have to before to really enhance and amplify those joyful learning experiences.

You make the case that teachers should be artists first. Can you tell us why?

When I first began teaching in 1989, there seemed to be a real push toward a standardization—and I don't mean that even in a negative way. But how do we ensure, first of all, that all students are given the same opportunities, which is an important conversation. But along the way, I felt like the message became, "How do we be all the same"? People would say, "A kid in grade four in one part of the province should have the same experience as a kid in another part of the province." While I understood that and what the goal was, part of it sort of reduced teaching and learning to a real science. When people asked the question, "Is teaching a science or an art?", everybody will say, "Both." However, I want to lean more toward: "What if we thought of ourselves as artists first"? If you ask a musician, "Are you a technician or an artist?", most musicians will say, "I'm an artist." There are high degrees of technical aspects and science involved in becoming a musician, but that's not how they see themselves. They see themselves as an artist. So, I begged the question: "What if as teachers we saw ourselves as artists?"

What I mean by that: the idea that each of us brings something individual and unique to the experience, and if teaching and learning is indeed a human experience first and foremost, beyond that content and the pedagogy, it's a human experience, then that human experience needs to be spoken about, thought about, and leveraged in whatever way that is. It starts by teachers seeing themselves as an artist: "What do I bring to this that's unique, special, and comes from the heart?"

You indicate that it is important for teachers to identify their unfair advantage. Can you talk about this?

That particular phrase came to me when I was listening to a podcast a few years ago called "Start-up." The podcast was about a guy trying to actually build a new company, which was ironically enough a podcasting company. He was meeting with a venture capitalist … he was trying to obviously get this person to invest in his business … he was giving all his business plans and how he was going to make money … and the guy finally said, "Not interested in that. I want to know what your *unfair advantage* is? I want to know what it is that *you do* that nobody else does?" Again, that really ties with that notion of being an artist, that I think teachers need to be intentionally thinking about, "What do I bring to the table that nobody else can bring?" And it can be the simplest thing. I remember teachers who once a month would bring cupcakes to school or something like that. People often look at those things as being just secondary or inconsequential, but they aren't. Those little things that people do and the stories that they tell make such a big difference. I really encourage teachers to think about how to be an interesting person, talk about the books that you've read, the movies you've went to, the hobbies that you have. If you think about some of the messages that teachers have been given over the years around, "They don't need to know who you are as a human being. You're there to teach content!" *No, you're not there to teach content, you're there to teach children!* And that requires a connection, so why not take advantage of you as an individual? That unfair advantage is a way I hope teachers see themselves as offering something unique and special that maybe nobody else can do just the way they do it.

You have argued that gratitude is an important form of validation for teachers and how infrequently this occurs in educational settings. Can you elaborate?

When I moved from working in a school district to my current job with "Discovery Education," which is a for-profit company, I was struck by how much gratitude is part of that culture. I've never worked for another company before so I don't want to make that a blanket statement. It was just my experience working with this group of people: how intentional they were about thanking you—thanking me for doing my job, not even doing anything extra or out of the ordinary. I would do my job and I'd have somebody from some department say, "Boy, I really just want to thank you for this …" And it wasn't just a thank you and that was it. It was explicit: "You did this really well and you really made this impact here." They would really speak into my life around the impact I made. It struck me and I thought: "When you work in a school you see adults doing amazing things all day long for children, and I don't know why, but for some reason we just don't do a very good job of pointing that out." Maybe part of it is just sort of the busyness of the day—it's frantic and people are moving and sometimes there's little time to pause and stop—but I know what a difference it makes.

It was just yesterday on Facebook I saw a post from a parent thanking a principal that I know from Texas and wrote this very long thing saying: "You must get this all the time, but I just want to say how it important was …" The principal had written a note to this little guy in her school who had been away sick for a couple of days—it wasn't anything serious—and had sent him a little handwritten postcard. And what an impact that made on the parent and the child … this amazing impact that gratitude has. It's one of the things and I've said it to leaders: "You've got all these initiatives that you're trying to do and that's great. But if you just decided to somehow double whatever gratitude you give out, that would have far more impact than any strategy or plan that you have right now." For some reason, education is just not very good at extolling gratitude.

Lastly, do you have any advice for educators and parents on the importance of joy in childhood?

The reason I talk about joy … it's a little bit of a pushback to some of the ideas—I don't say that they're bad—but they have taken us down not a great road. Things like standardized testing, the accountability movement—I'm not saying those are bad—I'm just saying that joy often got lost in those conservations. A more recent one that I'm quite concerned about is what I've called "the war on childhood." What I mean by that is a continual pressure for kids to succeed and take away their childhood—everything from this whole "helicopter approach" to parenting where we just don't let kids be kids. There is a school in North Bay, Ontario that decided it didn't want kids to do cartwheels any more—not because anybody got hurt—but because they could get hurt. Have we gone too far in that direction that we're robbing children of this really special time in their lives? You only get to be a kid for a very short period of time and could we maybe help slow it down. Not that schools are the defining answer to that. Obviously, parents are much important in that conversation than schools are. But could schools and educators think about: "How do we allow kids to be kids?" And even as they move through high school, with all the mental health issues, adults play a really important role in helping kids see what a healthy adult life looks like. One of the quotes that I share all the time is from Erica Bauermeister: "Adults need to have fun so children will want to grow up." That statement continues to resonate: What kind of a model can we be for kids?

The part that I'm concerned about now is that we're really not letting our children be children … it's such a wonderful time in life. I think back to my own childhood that was amazing and again, it was a different time and things aren't the same, but I do want all children to have that childhood experience that involves really intense moments of play, wonder, and belonging, and not be worried about what life is going to be like in 10 or 20 years or being future ready. Instead, childhood should be protected.

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Dean Shareski is the Community Manager for Discovery Education Canada. He taught grades one through eight for 14 years and spent nine years as a digital learning consultant for Prairie South School Division in Moose Jaw, Saskatchewan. In addition, he is an Adjunct Professor at Wilkes University. His blog consistently ranks among the top educational blogs. In 2010, he won the ISTE Award for Outstanding Leader of the Year. Dean has had the opportunity to speak to a variety of education audiences both nationally and internationally. He has recently authored "Embracing a Culture of Joy" and coauthored, "Different Schools for a Different World." His passion remains to help teachers explore the affordances of technology for learning and making joy an essential goal for all learners.

Considering Authority and Authorship in Technological Contexts in a Brazilian School

Viviane Cabral Bengezen and M. Shaun Murphy

Abstract

In this narrative inquiry, we inquired into the experiences of Everton and Lowise, two grade 6 English as a Foreign Language students in Brazil, using digital technologies and authoring their texts, in English. In the areas of Applied Linguistics and Education, we consider discussions about the writing process in English and the possibilities of working with genres to teach and learn English through digital technologies. The research participants lived and told stories of freedom, singularity, and responsibility, becoming authors when they left their signature on the professional knowledge landscape of school.

Situating the Inquiry

We understand that the dominant story of education is generally marked with stories of standardized tests, oppression, repetition, copies, reproduction, and failure, all over the world. However, there have been many individual stories that show it is possible to make a difference, develop collaborative work, and privilege multiple perspectives. We share in this paper the stories to live by[1] (Clandinin & Connelly, 1995) and experiences of a Brazilian teacher and two of her grade 6 students who became authors in a foreign language, using digital technologies. Connelly and Clandinin (2006) wrote,

> People shape their daily lives by stories of who they and others are and as they interpret their past in terms of these stories. Story, in the current idiom, is a portal through which a person enters the world and by which their experience of the world is interpreted and made personally meaningful. Narrative inquiry, the study of experience as story, then, is first and foremost a way of thinking about experience. Narrative inquiry as a methodology entails a view of the phenomenon. To use narrative inquiry methodology is to adopt a particular view of experience as phenomenon under study. (p. 375)

Employing a narrative inquiry (Clandinin & Connelly, 2000, 2011) methodology, we drew on the narratives of Viviane, who was an English as a Foreign Language (EFL) teacher in Brazil, and two grade 6 students, Everton and Lowise. Shaun joined Viviane as a coresearcher alongside her during the research and her graduate studies while in Brazil and after. From 2014 to 2017, Viviane narratively engaged with the youth, seeking to understand who they were, and who they were becoming on the school landscape, focusing on authorship and digital technology at school. Attending to how Viviane, Everton, and Lowise shaped their daily lives in school, we, the authors of this paper, sought to understand how they interpreted the world "and made [it] personally meaningful" (Connelly & Clandinin, 2006), and what that meant for us as teachers using digital technology.

In 2014, 126 grade 6 students, who had EFL classes twice a week with Viviane, produced texts of diverse genres in English, and had their texts published in an online book (Bengezen, 2016). In this narrative inquiry, we focused on the individual stories to live by of Everton and Lowise while they authored texts and their lives on the landscape of a public school in Brazil. We decided to tell and retell the stories of these two children, specifically, because of the way they used technology in different spaces in the curriculum, living and telling stories that were not about failure—despite the obstacles they faced. Everton, Lowise, and their parents have agreed to reveal their real names in order to honour who they are and recognize their role in the co-composition of this work. However, the real name of the school has been changed to a pseudonym because it is not the focus of this inquiry.

Issues of Methodology and Method

We came to understand Viviane's practice and the use of digital technologies as narratively constructed. As narrative inquirers, we see narrative as the method and phenomenon (Connelly & Clandinin, 1990). We are interested in the experiences people live and tell; we understand experience and we study it, narratively. Narrative inquiry is situated in a Deweyan ontology of experience and the,

> regulative ideal for inquiry is not to generate an exclusively faithful representation of a reality independent of the knower. The regulative ideal for inquiry is to generate a new relation between a human being and her environment—her life, community, world—one that 'makes possible a new way of dealing with them, and thus eventually creates a new kind of experienced objects, not more real than those which preceded but more significant, and less overwhelming and oppressive' (Dewey, 1981, p. 175) […] In this pragmatic view of knowledge, our representations arise from experience and must return to that experience for their validation (Clandinin & Rosiek, 2007, p. 39).

Clandinin and Murphy (2009) noted, "[t]hree features of a Deweyan ontology of experience are well suited for framing narrative research: emphasis on the social dimension of inquiry, temporality of knowledge generation, and continuity that is not merely perceptual but ontological" (p. 599).

Understanding experience narratively means that we considered experience in relation to the metaphorical three-dimensional narrative inquiry space (Clandinin & Connelly, 2000) with place, temporal, and social dimensions. This is understood "with temporality along one dimension, the personal and the social along a second dimension, and place along the third" (p. 50). Within this inquiry space we were able to see threads of experience woven across Everton, Lowise, and Viviane's stories to live by.

Narrative threads (Clandinin, 2013) attend to experience across lives. Rather than reduce experience to categories or themes, the concept of threads understands the complexity of experience in the entirety of a life. Minh-ha (1989) wrote, "[d]espite our desperate, eternal attempt to separate, contain, and mend, categories always leak" (p. 94). For this reason, we resist the temptation to categorize experience and, rather, consider that experience can be traced threadlike across the weaving of a life. Following the thinking of Clarke (2016), "[a]s researchers who struggle to separate our own identities into categories, we recognize the inappropriateness of trying to do the same in our exploration of the [stories to live by]

of our research participants" (p. 22). Therefore, we consider the threads that move across categories in our research.

We composed field texts during the 2014 school year, comprising field notes, reflexive journals, school attendance registers, class materials (handouts and assessments) produced by the teacher, Viviane, material (handwritten or posted on a virtual platform—comic strips, drawings, animations, T-shirt slogans, lyrics, word clouds, avatars, and poems) produced by the youth, WhatsApp messages, Facebook conversations, and digital photographs.

Moving from field texts as we composed this final research text, we wrote interim research texts, drawing attention to moments and places of tensions, and moments when our stories were being shifted. Considering the metaphorical three-dimensional narrative inquiry space (Clandinin & Connelly, 2000), we identified the narrative threads which wove through the stories we lived and told on the landscape of school. From our attention to these threads we co-composed this relational research text.

Considering the relational aspect of narrative inquiry, within a view of knowledge as personal, embodied, narrative, and shaped through their lived experiences (Bruner, 1986; Clandinin, 2013; Clandinin & Connelly, 1995; Clandinin et al., 2006; Connelly & Clandinin, 1988), we understood that through a collaborative kind of research such as narrative inquiry, it would bring us into school, opening up new questions about our responsibilities as researchers, and the ways our research texts attended to the participants' lives. We began this research with wonders about composing a story to live by: How is authorship taken up in the lives of youth in digital contexts and what do these experiences with authorship tell us?

In the sections that follow we introduce Everton in order to situate our thinking about how technology can support identity making in schools. We move into a discussion about genre work related to technology. We then focus on the experiences of Lowise and how technology helped her to foster a connection to school. The next section includes a discussion about Everton and Lowise together before our final conclusion. We selected the two youth to be the focus of this study in order to inquire more deeply into their experience. We were particularly interested in Everton and Lowise because their work supported our research into how technology can support authorship and the creation of a story to live by in educative ways (Dewey, 1938).

A Thread in Everton's Secret Stories

First, we introduce Everton, by drawing on field texts that show our coming to know him as a youth who began grade 6 for the second time. Following are some of the ways Everton described himself to his teacher, Viviane, and his classmates.

Everton M. to ■ Uberlândia Views and Voices

Hello!My name is Everton .My favorite color is white .My favorite band is AC/DC.My favorite sports is Capoeira .My favorite TV Show is I Carly .My birthday is in february .My best friend is Ludmila,Isabella, Iohann. I have one sister Brunna. My celebrity is Gr. Corrisco. I'm 13 years old. I' m from Monte Carmelo, Minas Gerais, Brasil. I study at Escola ▬▬▬▬▬▬▬▬▬ ▬▬▬▬and I am in 6th grade. I live in Uberlândia,Minas Gerais,Brazil. I am a Chelsea fan. I'm anxious,organized,crazy,funny and Happy! I love chocolate, ice cream and lasagna! I love English class, physical education and arts. Bye And that was my profile! Show Less

Like • Reply • Share • Follow   Mar 26, 2014

Fig. 1: Everton's profile shared on Edmodo, March 26, 2014

This profile that Everton shared on Edmodo, a virtual platform used by his teacher Viviane to communicate with her grade 6 students, helped us to narratively understand the authorship experiences of youth in schools when they use digital technology. We position ourselves in a tradition of curriculum studies grounded in Dewey's (1938) concept of experience and Schwab's (1973) concepts of curriculum commonplaces. We were interested in understanding the stories of authorship that the youth told in schools in relation to Schwab's curriculum commonplaces of learner, subject matter, teacher, and milieu, and Dewey's (1938) criteria of experience understood by the terms of continuity, interaction, and situation.

In Brazil, most studies related to authorship were developed in Portuguese teaching and learning contexts, based on the theoretical assumptions of Foucauldian discourse analysis, among other French post-structuralist perspectives (Fernandes, 2016; Possenti, 2016; Brait, 2016). In education and applied linguistics, the focus has been on the product accomplished by the teacher or student, with no interest in how individuals felt while writing or what is the process of producing texts in schools and universities. Almost all the investigations focused on the authorship of final texts, but not the experiences of producing those texts.

In this work, however, our focus was not on the final texts produced by the youth. Rather, we were interested in the process, and in narratively understanding the stories of authorship lived and told as one way of inquiring into the youth's stories to live by. We understand authorship related to voice and signature (Clandinin & Connelly, 2000), that is, the production of texts with the mark of the author's identity, their story to live by.

Drawing on the work of Morris (2001), we contemplated Everton's experiences,

> At the beginning of 2014, when Viviane, Everton's teacher, entered one of her grade 6 classrooms and saw Everton, she was amazed, "What are you doing here, Everton? You are supposed to be in grade 7, aren't you? Which subject did you fail?" He responded, "Only Portuguese, teacher!" (Field notes, February 12, 2014)

Everton's response left Viviane even more surprised, since they were Brazilian, and Portuguese was their first language. Viviane was and had been Everton's teacher of English as a Foreign Language, referred to as English classes. The school system in which Viviane worked was in a city in central Brazil. From grades 6 to 9, the students had one teacher for each subject (Portuguese, Math, Natural Sciences, History, Geography, English as a Foreign Language, Physical Education, and Arts). In grade 6, if a student failed just one subject, they had to do the whole year over again; physical education and arts could not fail a student. Considering Everton's experience (Morris, 2001), we wondered about how his story to live by was "mis-educatively" (Dewey, 1938) shaped by this experience of repeating the grade, and the ways he composed a forward-looking story in relation to his work with Viviane in technological contexts.

Everton told us how he felt in relation to different spaces on the school landscape, and in relation to different teachers:

> English classes, for me, were always a good thing, where not only were we writing things that the teacher wanted, but things we wanted. In English classes with teacher Viviane, we performed several dynamics, went to the [computer] lab frequently, and wrote various texts where we could choose what to write. We had more freedom to write. We could show and express what we felt. (Field text: WhatsApp conversation between Viviane and Everton, May 13, 2016)

As we read Viviane's field notes, conversations with Everton, Everton's texts, and told remembered stories of the experiences at school, in Brazil, we further wondered about the space of the computer lab, the authorship of youth, their signature of personhood on the texts they produced, the relation between language and identity, and our responsibility, as educators, in listening to their voice. Viviane's English classes took place in the classroom as well as in the computer lab. Everton had a lot of fun with computers and felt good about being able to help his classmates. They were able to communicate using a virtual platform, Edmodo. The first English texts read by Everton were Viviane and Shaun's profiles. Since Viviane's EFL pedagogy was based on genres (Cristóvão & Beato-Canato, 2016), and since the first activity the grade 6 students did was to write their own profiles in English, they needed to read many authentic samples of each genre. Therefore, they began by reading Viviane's and Shaun's (Shaun had joined the group on Edmodo as a foreign participant. The Brazilian students were excited to have a Canadian who could read their texts).

Everton uses technology in supportive ways. In addition to Viviane and Shaun's profile, Everton had read other people's profiles during the previous year. Viviane's students were exposed to seven texts representing the profile genre. They identified the cultural context in which those texts function, what social purposes they served, and how their structures reflected their functions. Viviane and her students engaged in a study of the genre profile, negotiating, developing content knowledge, talking, note-taking, observing, discussing, and then working to collaboratively produce a profile (a version of the genre). After all this work, Everton was able to construct a version of his own profile, drafting the text, talking to his teacher and classmates, editing, and publishing his text on Edmodo.

Everton's classmates used to ask him for help because he was more familiar with digital technologies and had more experience, ability, and skills with the activities on the computer than in the notebook:

> I think I felt more valued in English classes, because Viviane took us to the computer lab a lot. I loved creating an avatar that spoke English. I liked to finish my assignments soon so I could get up from my chair and walk around the computer lab to help my classmates who were unable to develop the activities proposed in English classes. On Edmodo, as soon as I published my avatar, one of my classmates asked for my help. I liked this position of who can do things and be popular in school. However, I think the other teachers did not see me like this, as some students saw me, or how Viviane saw me. In general, I felt a bit unsuccessful at school, having repeated years. It seems that everything I knew was not good for school. (Field text: WhatsApp conversation between Viviane and Everton, May 14, 2016)

Although Everton was doing grade 6 for the second time, he did not feel uncomfortable all the time, only in some spaces, with specific teachers. He saw himself as a knower, however "everything" he knew "was not good for school." As we listened to Everton tell his stories, we could hear how hard it must have been for him to still attend to all the subjects in grade 6, for a whole school year again, being judged by others. On the other hand, in some spaces at school, such as the English classes, Everton felt empowered as "a person who can do things and be popular in school." He continued,

> for me, writing my first English text was a fantastic thing, because it was an easy thing. I imagined that would be impossible, but the classes were showing me that I was able to do it. The profile I wrote in English helped me a lot, and then I started to write some texts in English. It made me want to write, I really like writing songs nowadays. (Field text: WhatsApp conversation between Viviane and Everton, May 14, 2016)

As we listened more to Everton tell his stories, we could hear how he liked to write and observed how he positioned himself as a writer and a knower. Everton was not afraid to assert himself in the EFL classes. Consequently, he took a leading role in the class, which we also noticed in his experiences writing a profile, helping classmates, and using the computer. We became interested in the ways Everton positioned himself and how he expressed his stories to live by in school.

This was possible because technology was used in new ways and Everton could use the computer and the Internet to learn English by reading and writing authentic texts, which are part of the digital technology world. Technology opened up a space for Everton in his work. There was an interplay here between Everton, Viviane, and technology. Technology was part of this interwoven identity-making place for Everton and, along with the work in the various genres, supported him in his learning and in his identity making (Clandinin et al., 2006).

Threads of Connection: Lowise Builds a Bridge Between the School and Hospital

The second participant, Lowise[2] (in memoriam), was a student who had chosen to author a T-shirt slogan at the end of the school year. In March 2014, Lowise posted her own profile on Edmodo in English. It is important to underscore that Lowise was not proficient in English, nor had she any help at home

related to English. She established a relationship with her teacher, Viviane, through the Internet. Lowise followed the instructions, read the profiles that were available on the Internet, and wrote her own:

Fig. 2: Lowise's profile on Edmodo

After producing this text, she created an English-speaking avatar using the site Voki. She chose the character, voice, and accent, typed the text in English, and shared her product on the Internet. Lowise also had Skype conversations with Viviane, and was assessed, even though she was mostly in a hospital room, during her cancer treatment. Before composing the research texts where Lowise was the participant, Viviane had long conversations with her mother, Larissa, who thought it was important to tell Lowise's story and the struggle to create opportunities for the authorship of children who are in a hospital for treatment. In 2015, when Viviane was no longer Lowise's teacher, the school decided to fail her, arguing that Lowise was in hospital and not capable of going to grade 7. Some months later, she died.

After Lowise passed away, Viviane had an appointment with Larissa. It was essential for Viviane to know whether or not Larissa wanted to tell Lowise's story. Larissa would be the one to decide if her daughter's story would be published, despite the pain caused by remembering the experiences Lowise had lived when she was Viviane's student. In Larissa's home, Viviane listened to Lowise's story among many tears, smiles, hugs, surprises, and emotions. It was the first time Viviane saw the story from Lowise's mother's point of view, and Viviane was surprised, because she didn't know how much Larissa had fought for Lowise's right to learn. While Lowise was in the hospital, it had been extremely difficult for Larissa to keep her daughter connected to her classes and teachers, so much so that at one point Larissa thought she was losing her mind.

In 2014, Viviane put into practice the ideas Larissa had about the schoolwork that Lowise could develop, even though she was undergoing treatment in hospital. Larissa was referring to the EFL classes Viviane taught to Lowise via Facebook, e-mail, Edmodo, and Skype. Larissa comments that this entire relationship built through the Internet had meant so much to her and Lowise. Larissa said that her daughter, "did not know she knew English," and that she felt important when she was doing the tasks Viviane proposed. She liked being able to have contact with the school, even from a distance; she realized that she could accomplish the tasks, make choices, create, and build knowledge.

When the school decided to fail Lowise in 2015, Larissa fought to prove that the system was wrong, and that it was the school that should prove that her daughter was not able to enter grade 7. Larissa brought the case before the Civil Court. The case was reviewed by the court and the school failed to prove that Lowise was unable to attend grade 7, therefore the school's decision to fail her was not upheld.

In addition to being highly emotional, Lowise's story is relevant to the academy and to school contexts, as it presents tensions related to authorial opportunities created (or not) by school, authorship opportunities of students undergoing medical treatment, the understanding that most teachers have about what it is to learn and teach, and the creation of knowledge communities and narrative authorship. Significantly, access to digital technology made this possible for Lowise.

Writing a Story to Live By

Everton's manner in the computer lab drew our attention. He took a leading role when engaging in class activities. When he helped classmates, he did not readily give the answers. Rather, he gave the other youth the opportunity to speak. He asked questions, showed his classmates how he had carried out his assignment, but did not do their work for them. Everton was engaged in the act of constructing knowledge, rather than transmitting it. Lowise was also constructing knowledge without the presence of the teacher, since she had found an autonomous way to learn and share her findings. They did this in different places related to the classroom through the use of technology.

The inside and outside classroom places are epistemologically and morally different on teachers' professional knowledge landscape (Clandinin & Connelly, 1995). According to Clandinin and Connelly, living in these two epistemologically different places on the landscape creates dilemmas for the teacher, since within the classroom the teacher finds a safe place to live her stories, created in the relationships with her students. Outside the classroom, in school contexts, the teacher does not feel safe to live and narrate her stories. Murphy (2004) wrote about the inversion of these places for the children; we wonder how Everton and Lowise felt as they were positioned on these two places on the landscape in such different ways in relation to technology. Our consideration of their location on the landscape in relation to school challenged us to consider the complexity of their relationship to school, which was often mediated by technology, and therefore affecting the production of their texts. We wondered if, for Everton and Lowise, there would also be a reversal of places in the landscape in terms of safe and unsafe, as Murphy (2004) suggested, but in a different way: were the virtual spaces where EFL classes took place safe places, where they felt free, capable, and respected?

Viviane shared authority (Oyler, 1996) with Everton and Lowise as they created English-speaking writing spaces in grade 6. When they felt their experiences were being valued and their voices heard, they began to leave their mark on the school landscape. Everton loved to walk through the computer lab and talk to other classmates, always willing to help them do the assignments. Lowise loved to engage in the EFL activities through Edmodo, Facebook, and Skype, but while she was in the hospital during the school

year Lowise only attended Viviane's classes three times in person. All the other activities were developed at a distance using digital technologies.

We consider the possibility that Everton and Lowise had different school stories to live by in EFL classes because what they did was not what the school validated or allowed. For Everton, this involved standing up and moving around, talking to classmates, collaborating, sharing knowledge, sending stories to his teacher, and posting his assessments on the Internet. For Lowise, it was the delivery of activities through the Internet and not attending classes regularly. Technology for Lowise and Everton shaped a different way of being.

Relationships built on digital landscapes. Everton told us that if he had been more considerate and learned the contents by heart, he would not have failed the previous year. In other words, by demanding from him a reproduction of the subject matter taught, which he was unable to provide, the school had unwittingly stopped Everton's authorship. Lowise thought that if she was not sick and had been able to attend school regularly, she would have been capable of going to grade 7, although some teachers and coordinators thought otherwise. On the other hand, Everton and Lowise said they had more freedom to write in EFL classes. They could show and express what they felt. Freedom, in this case, promoted the possibility of authorship.

As we considered Lowise and Everton's stories, we began to understand that there are different paths of authorship, and the path one follows depends on the lived stories and relationships temporally built on different landscapes. Some of the landscapes where this story took place were the computer lab, the hospital, and the virtual spaces of Facebook, Edmodo, and e-mail. Somehow these places were not part of the school for them, and in this space they could be more themselves and through it they felt a connection to Viviane. Lowise was at the hospital almost every day, but participated through the Internet. Physically, Lowise felt very weak and was not able to go to school. However, despite being in hospital, the digital technologies allowed her to learn and share.

Over time, the landscapes where Everton, Lowise, and Viviane shaped their stories to live by existed in the classroom, the virtual space where they exchanged e-mails, as well as in the computer lab and the school yard. The relationship between Viviane, Lowise, and Everton, in and out of school, helped the children trust her in order to live their experiences of writing, reflecting, and building their personal practical knowledge (Clandinin, Connelly, & Craig, 1995; Craig, 1995; Murphy, 2004). The teacher-student relationship is fundamental to the construction of student and teacher stories to live by. Everton and Lowise felt encouraged to continue writing, positioning Viviane as their first reader, then their classmates, and then a bigger audience when they published their texts on the Internet. To validate their stories, Viviane tried to travel to their worlds (Lugones, 1987). She sought to take into account Everton and Lowise's stories to live by, and their personal practical knowledge.

Recalling the criteria of experience (Dewey, 1938), continuity, and interaction, we understand that Everton and Lowise's experiences with digital technologies at the EFL classes were educative, as they moved towards future authoring endeavors. If it had been possible to continue working with these

two participants for a few more years, we imagine that they would have built a strong story of authorship, mainly because they had already found their own voice in writing, in addition to leaving their mark on the field of research.

Conclusions

When Viviane entered the research field in early 2014, she was seeking to live and understand experiences of authorship in her teaching practice and, in a relational manner, to understand the experiences of authorship experienced by her students, especially on the digital landscapes at Aquarela School. She made attempts at authorship for herself, teaching English using digital technologies, and wondered about the future for herself, Everton, and Lowise. Investigating the stories she shaped with the youth, she realized she was learning to be a different teacher (Murphy & Bengezen, 2015). Like the youth, she was authoring in technological environments. She was changing her story as a teacher. In contrast to the homogenized stories she had previously experienced as a teacher, she began to think more deeply about the needs of the youth, each in their own specificity, and not perceived by her.

Everton and Lowise helped Viviane understand the stories they were living and authoring. Viviane lived, according to her, successful stories, creating safe spaces and traveling to the worlds of the youth, but she also experienced stories of failure. In understanding these stories as attempts, we are able to point to the transformative character of them, recognizing and imagining future possibilities. As Viviane lived within her teaching experiences, the youth also lived authoring experiences in the English classes. This is the relational aspect of curriculum making: they were all learning together. The experiences alongside the youth, often in relation to technology, helped Viviane share authority with them and create English-speaking writing spaces in the sixth grade. When the youth felt their experiences were being valued and their voices were being heard, they began to make their mark on the school landscape.

Everton loved to walk through the computer lab and talk to classmates, always willing to help them do the assignments. The tensions experienced in Everton's stories were mainly due to the fact that he was a repeating student who was seen by his teachers as a problem. Viviane did not understand how a youth like Everton, who wrote incredible stories, helped his classmates, and was a proficient computer user, could have repeated the year. With him, she learned that the school can prevent authorship, rather than promote it.

Lowise was the author of a profile, an avatar, and a T-shirt slogan, always eager to share who she was and who she was becoming as she moved from hospital to school and family settings. Her mother Larissa was a model of resilience and persistence who never gave up fighting for her hospitalized daughter's right to belong to a knowledge community like a school. With Lowise and Larissa, Viviane learned how to listen to the story of the other and how to validate this story, pay attention to it, show empathy, and deal with vulnerability.

The stories of authorship that Viviane and the children lived were stories of sharing authority, responsibility, community, freedom, protagonism, rereading, signature, negotiation, relationship, ethics, and safe spaces. We can consider these stories as separate events from what Viviane and the youth did together. However, these are also threads in lives and across lives, not stand-alone stories. As Dewey (1938) taught us, every experience shapes future experiences, and is modified by them in return. The threads traveled across Viviane and the youth's experiences together. One thread can be found in another thread, and in their weaving together a life is shaped. Our lives can be understood in the relational space of the other. Viviane knows herself as a teacher and a woman in the space she shared with the youth, and it is evident from their work together that the youth understood themselves in part in the space Viviane inhabited.

In this paper we discussed authorship and authority. We see the two related through the ways the authorship of the youth supported their authority over school spaces and their learning. Significantly, technology helped them accomplish this in diverse ways and positioned them in relationship to the school landscape as knowers, as people with authority. Lowise and Everton were not only learning English in a technology-rich environment, but also learning about themselves.

Notes

1. "Stories to live by" is a narrative term for identity. It takes up a narrative understanding of experience situated along a continuity of life understanding that we are composed of the experiences (stories) that we have lived.
2. During this research, Lowise died from cancer.

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"Why Haven't I Tried Twitter Until Now?":
Using Twitter in Teacher Education

Jeffrey P. Carpenter, Mike P. Cook, Scott A. Morrison, and Brandon L. Sams

Abstract

As teacher educators, we have used Twitter with the goal of jumpstarting the professional learning networks and teacher identity development of students in our courses and programs. Our use of Twitter has evolved over time and can inform the work of other teacher educators. In this article, we offer examples of the benefits of incorporating Twitter in teacher education. We describe some of the common challenges we have experienced at our two institutions and across multiple semesters of use. Based on our collective experiences, we offer recommendations to others who are using or are considering using Twitter with preservice teachers.

"Why haven't I tried Twitter until now? Seriously enjoying it. Oh, I'm also no longer an egg! #AuburnELA"

--Tweet from a preservice teacher

Background

We have been using Twitter with preservice teachers (PSTs) for almost five years in a variety of contexts, from introductory courses covering foundations of education to methods courses at the elementary, middle, and secondary levels. In that time, we have found the social media platform to be an effective tool for enhancing course content and expanding the walls of the classroom. Moreover, we have seen how it can help PSTs expand their professional learning networks (PLNs) and diversify their opportunities for growth. Although we cannot claim that we have exhausted the possible uses of Twitter in teacher education, we discovered what we consider to be promising practices. The purpose of this article is to share what we have learned. First, we provide an overview of Twitter. After a brief literature review on the uses of Twitter in education, we offer an example of how Twitter can be used to help students develop their teacher identities. Then, we outline six challenges that we have faced when using Twitter followed by six recommendations for overcoming those challenges.

Twitter 101

Twitter is a microblogging platform that allows users to share short multimedia messages, known as *tweets*, with other Twitter users. Tweets can include up to 140 characters of text as well as hyperlinks, images, video, and live feeds. In contrast to Facebook, Twitter is an open social network that allows for asymmetrical relationships in which one user follows another but may not be reciprocally followed back.

It is normal for individuals to communicate with other users with whom they have no face-to-face relationships. Over the last several years, educators have used Twitter as a means to make connections, expand their spheres of influence, and collaborate with others.

The widespread use of *hashtags* (keywords preceded by the # symbol) is a Twitter convention important for understanding the platform's usefulness to educators. Hashtags have been employed to create "affinity spaces" (Gee, 2004), such as #literacy or #enviroed, where educators with common interests and needs can share ideas and resources and engage in conversation (Carpenter & Krutka, 2014; Rosenberg, Greenhalgh, Koehler, Hamilton, & Akcaoglu, 2016). Live chats make the platform popular with many educators. Twitter chats are moderated, hour-long synchronous conversations that typically occur on a weekly basis. At last count, there were over 200 chats related to a variety of education topics (for more on Twitter chats, see Gao & Li, 2016; Luo, Sickel, & Cheng, 2017). Hashtag affinity spaces and live chats make Twitter an easy way for educators to interact with colleagues beyond their schools, districts, and regions, thus combating the isolation that has often characterized the teaching profession (Carpenter & Krutka, 2014).

Research on Twitter

Twitter in K-12 education. Our initial interest in using Twitter in our work as teacher educators was a result of our seeing how some in-service K-12 educators were putting it to use. Recent studies highlight Twitter's potential to support the work of K-12 professionals (e.g., Greenhalgh & Koehler, 2016). While collaboration among educators has traditionally been limited to interactions with peers from the same school or district, Twitter opens up the potential for educators to interact with a wider pool of colleagues (e.g., Visser, Evering, & Barrett; Wesely, 2013). Survey research by Carpenter and Krutka (2014) found that many respondents valued Twitter's capacity to reduce different forms of isolation and the personalized, positive, and collaborative community it facilitated. Although the extant literature suggests that K-12 educators primarily have used Twitter for purposes of their own professional learning and development (Carpenter & Krutka, 2015), there is also a small body of research that points at potential uses of Twitter with K-12 students. For instance, Twitter has been employed to connect students to experts and formatively assess student understanding (Becker & Bishop, 2016), as well as to increase student engagement in discussions of class content (Hunter & Caraway, 2014). Given such uses of Twitter by K-12 educators, teacher educators have reason to consider possible applications of Twitter during teacher preparation.

Twitter in higher education. Twitter's use by tertiary students as a part of their coursework has received substantial attention from researchers. Prior studies have suggested that Twitter can contribute to university-level teaching and learning processes in a variety of ways and across diverse content areas, such as marketing (e.g., Barn, 2016), nursing (e.g., Waldrop & Wink, 2016), and science for nonscience major courses (e.g., Halpin, 2016). In one of the seminal studies on Twitter in higher education, Junco, Heiberger, and Loken (2011) reported that students using Twitter as part of an introductory seminar course for pre-health professional majors had significantly higher engagement and grades than control group students. Studies have generally found positive student perceptions of Twitter's use in education (e.g., Elavsky, Mislan, & Elavsky, 2011; Gikas & Grant, 2013). For example, in Rinaldo, Tapp,

and Laverie's (2011) research, students in four different course sections indicated that Twitter helped increase involvement and course satisfaction and facilitated achievement of their academic goals.

Twitter in teacher education. In addition to such research suggesting Twitter's benefits to teaching and learning in higher education generally, the use of Twitter in teacher education has been the subject of a handful of studies in recent years. In one of the first such studies, eight PSTs in New Zealand used Twitter during their student teaching experiences to share brief reflections regarding daily experiences in the classroom (Wright, 2010). This activity helped PSTs generate and develop self-reflection, while also mitigating the potential isolation and emotional overload of student teaching. Similar to the research in higher education generally, PSTs typically perceive benefits to the use of Twitter in their courses (e.g., Carpenter, 2015; Krutka, 2014). For example, the 20 PSTs in Cook and Bissonnette's (2016) study considered Twitter a useful dialogic space. Twitter has also been credited with helping PSTs move beyond passive consumption toward functioning as active creators of information (Nicholson & Galguera, 2013) and extending engagement with course materials and concepts (Carpenter, 2015).

Twitter's capacity to connect PSTs to other educators has been noted in several studies. Lord and Lomicka (2014) reported the benefits of Twitter use in teacher education in terms of the formation of a community of practice among preservice and in-service language teachers ($N= 80$). In Carpenter's (2015) study, PSTs interacted via Twitter with a wider variety of K-12 education stakeholders than their coursework and field placements typically enabled. Benko, Guise, Earl, and Gill (2016) reported that Twitter provided PSTs with opportunities to "participate with communities of practice, and write for an authentic audience" (p. 21). The connections that PSTs make with in-service educators via Twitter can also persist beyond graduation (Carpenter, 2015). For example, Risser (2013) described the case of a novice high school mathematics educator who used Twitter to create for herself an informal mentoring network that facilitated her successful transition from student teacher to first-year teacher.

Literature on Twitter use in other educational settings suggests some related obstacles (e.g., Kruger-Ross, Waters, & Farwell, 2013; Tang & Hew, 2016), and the extant research related to Twitter in teacher education also indicates that challenges can accompany its use. Despite common depictions of PSTs as "digital natives" who intuitively understand technology, the relevance and potential utility of Twitter has not always been apparent to PSTs. Several studies (Carpenter, 2015; Cook & Bissonnette, 2016; Krutka, 2014) have noted a minority of PSTs who were initially skeptical or dismissive of Twitter. Cook and Bissonnette (2016) found that PSTs experienced several obstacles in their uses of Twitter to share their developing positions on social justice related topics, including difficulty extending in-class conversations and trouble negotiating the social norms of the platform. Benko and colleagues (2016) suggested that PSTs using Twitter "may need scaffolding and guidance for developing critical reflection skills and maintaining involvement in communities of practice" (p. 1). Even when such support is provided, a single course experience may not be enough to convince some PSTs to continue professional use of Twitter. For example, Carpenter (2015) followed up with PSTs ($N= 20$) in the semester after they had been introduced to professional use of Twitter and found that while they almost all still maintained positive attitudes towards such uses of Twitter, the majority did not utilize Twitter as a resource during their student teaching semester. While it is apparent that Twitter can potentially support PSTs'

development, it also appears that such benefits can be challenging to realize. As is the case with almost any pedagogical tool or strategy, successful use of Twitter with PSTs seems dependent in part on how teacher educators implement and scaffold its use. We seek to provide practical and specific guidance for using Twitter in teacher education based on our collective experience using Twitter in a variety of different courses at two institutions.

Developing Teacher Identities on Twitter: Cases From Our Programs

As teacher educators, we help students *become* teachers. We do more than help them acquire new knowledge and skills. We support their development of new identities in a professional community (Zoch, Myers, Lambert, Vetter, & Fairbanks, 2016). In *Teaching Selves*, a landmark text on teacher identity, Danielewicz (2001) argues that professional identity formation is a key factor in teacher development, attrition, and job satisfaction. Representative of the sociocultural turn in literacy-and-identity studies, Danielewicz sees identity as negotiated and produced through discursive practices (Gee, 2000; Street, 2000). Because (teacher) identity is never given or natural, but continually negotiated in relation to institutions, communities of teaching practice, and cultural scripts and larger narratives of "good teaching," it is important that teacher education programs take identity seriously and design programmatic structures and experiences for its deliberate and ongoing construction. Examples of these structures and experiences include giving PSTs opportunities to collaborate with each other and with the profession, to exercise agency and authority when possible, and, through both, to be recognized as a teacher. Simply calling our students teacher candidates is not enough. PSTs need opportunities to create and try on an "identity kit" of teaching— which includes ways of speaking, writing, and interacting as and with teachers (Gee, 1996, p. 142).

PSTs can use Twitter to try on and practice a professional identity. They can accumulate professional resources, be recognized as a member of the teaching community, and contribute to the learning of others. Twitter offers PSTs opportunities for both identity exploration and development of early career professional learning networks (PLNs). As digital tools afford teachers opportunities to engage with exponentially more educators and resources online, PLNs are playing an increasingly important role in educators' ongoing growth (Mackey & Evans, 2011; Trust, Carpenter, & Krutka, 2017; Trust, Krutka, & Carpenter, 2016). We recognized the strong potential of Twitter for supporting PSTs' emerging professional identities and learning networks.

To this end, and in an effort to encourage our students' Twitter use, Authors 2 and 4 "made a bet" that the National Council of Teachers of English (NCTE) Twitter account would like or respond to the tweets from our students. This hunch, as the exchange below makes clear, turned out to be true. Dialoguing with professional organizations like @ncte has changed how many of our students perceive themselves as present and future teachers. Consider Sally, a senior, and Leslie, a junior (all names are pseudonyms); both are English education majors. Sally and Leslie began the program with little to no previous experience using Twitter, whether for personal, educational, or professional purposes. While initially uncertain of how to participate and what the benefits might be, they were eager to have a nontraditional way to contribute to class and meet participation expectations.
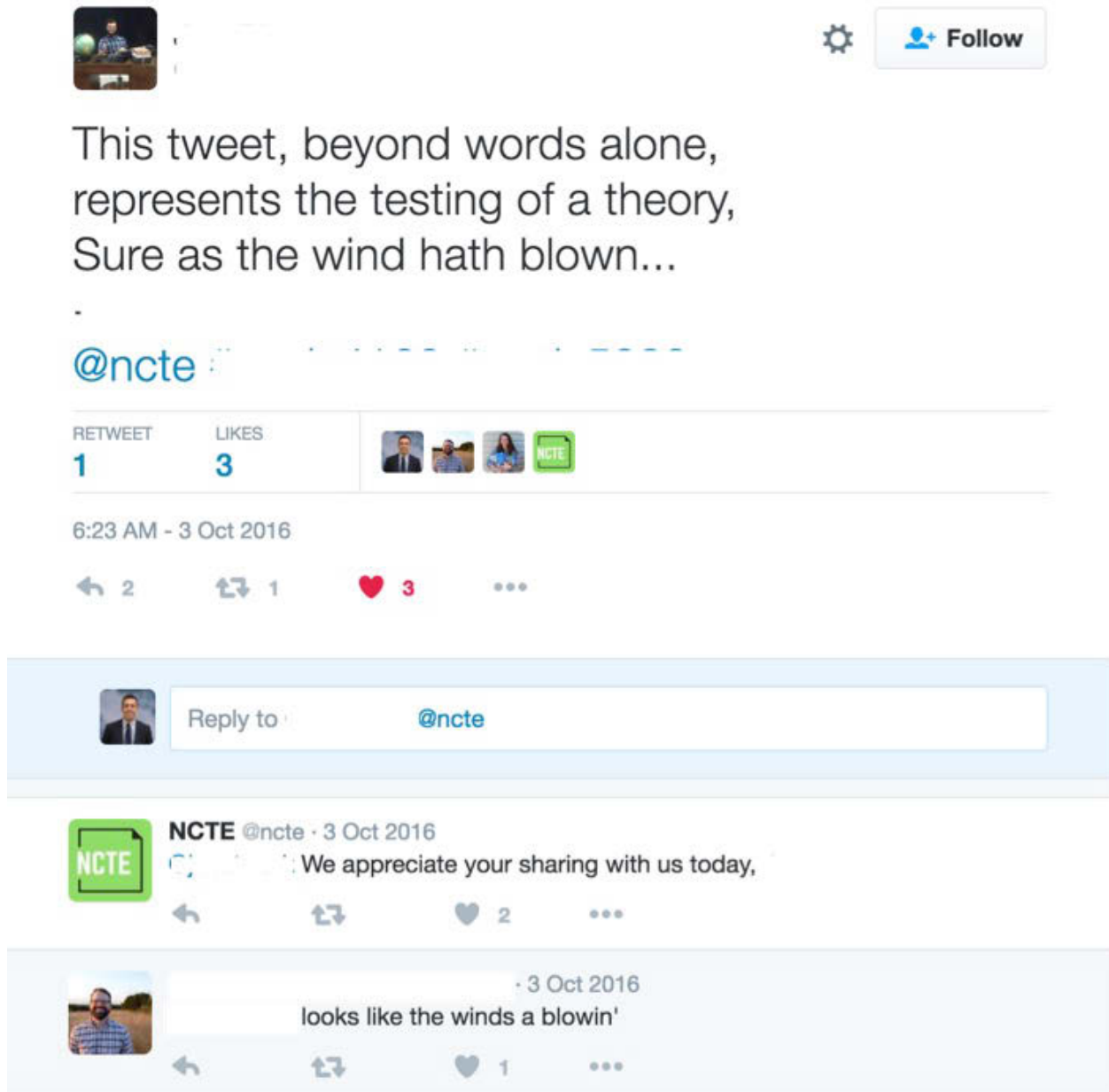
Fig. 1: Preservice teacher's Twitter exchange with professional organization account

At the outset, we encouraged them to look to our accounts for suggestions of who to follow, including teachers, professors, and organizations. Following and interacting with @ncte served as a catalyst for many valuable learning experiences. Their first interactions with @ncte came in the form of sharing an article or blog post with their classmates. What they immediately found was that @ncte responded by thanking them for their contribution. As the semester progressed, and Leslie and Sally experienced continued acknowledgement from @ncte, they gained confidence and increased their participation.

This began to take the form of tweets composed and sent to @ncte (and to their classmates and professors), rather than just likes and retweets of existing material.

To date, @ncte has liked, retweeted, and/or responded to multiple tweets from Leslie and Sally. These are important moments of professional recognition for our students. As they negotiate a complicated boundary identity, between student and teacher, being recognized by their professional organization as valued members increases their confidence and helps them develop a professional voice. Being recognized by and in dialogue with "the profession"—as represented in this case by @ncte—has helped our students deepen their engagement with course material and widen their professional conversations with members of the ELA teaching community.

In addition to widening their network of mentors, Twitter offers PSTs an alternative way to participate in and contribute to required coursework. We have encountered PSTs who were typically reticent to participate in traditional large-group, face-to-face classroom discussions, but willingly share their opinions and analyses via Twitter. Jackie's story is another illustrative example. She was a relatively shy student who typically spoke up in class only when required to do so, but she found Twitter to be a useful way to contribute her ideas related to course content. During the semester, Jackie sent the most tweets, tweeted at people the most, gained the most followers of any of her peers, and participated in more than the required number of chats. Jackie went on to be hired by a principal who was an avid Twitter user and was impressed that she had already begun to develop a professional Twitter presence prior to her graduation. Now in her fourth year as a teacher, Jackie continues to use Twitter with her students, for her own professional learning purposes, and as a virtual mentor for our current PSTs.

We present these examples not to suggest that success automatically occurs with Twitter use, but to provide glimpses of the possible benefits. We have seen similar scenarios unfold across our different courses, programs, and institutions. However, we have also experienced our fair share of growing pains as we have learned how to best use Twitter as teacher educators. So that others can benefit from—and perhaps avoid completely retracing—our learning curve, we describe in the following section some of the challenges that we have navigated.

Challenges

> *"I'm really stretching things here, trying to find a way to connect my #ElonEd tweets to education. Any suggestions?"*
>
> *--Tweet from a preservice teacher*

While the potential benefits in teacher education abound, there continue to be obstacles associated with incorporating Twitter into teacher education. Below, we discuss six challenges we have experienced: (1) the disconnect between personal fluency and professional know-how (Kumar & Vigil, 2011), (2) the perception that Twitter is outdated, (3) the integration of Twitter into course content (Lowe & Laffey, 2011), (4) the reluctance to imagine useful Twitter professional development, (5) the use of hashtags to organize information, and (6) the evaluation of Twitter participation.

First, our PSTs sometimes struggle understanding the relationship between personal and professional Twitter use. Many already use Twitter personally. While we initially anticipated this would help them understand the potential of professional Twitter, we quickly realized the opposite was also possible. One student, for example, posted frequently about Taylor Swift on a personal account and was completely at a loss for how to use Twitter for professional purposes. PSTs may perceive the gulf between their personal and professional use as too wide a chasm to cross. We were not initially explicit enough about the mechanics of professional participation on the platform (e.g., liking, retweeting, using hashtags), and failed to discuss the relationship and potential tensions between personal and professional tweeting.

Second, a number of students expressed concern that Twitter is outdated and has been replaced among their peers by tools such as Instagram and Snapchat. We heard the phrase "I don't do Twitter" on several occasions. In some instances, initial forms of resistance grew into fixed positions. This was, in part, because in our early attempts, we failed to appropriately explain our goals for Twitter use to our students. We assumed that because we were intrigued by how in-service teachers were using Twitter professionally, our students would also be. We required students to use Twitter without first helping them to see it as one tool for PLN development and a space in which PSTs can practice being teachers by creating, contributing to, and learning from a diverse network of educators.

Third, when we initially implemented Twitter in our courses, we made the mistake of framing it as something done *outside of class* to extend and enrich our in-class conversations. This led to some PSTs seeing Twitter as a side conversation, only slightly related to the main content of the course. We didn't help our students understand how their Twitter use could contribute directly to their grappling with and learning of core course content. If PSTs perceive Twitter and the classroom to be two disparate spaces, participation will often lag.

Fourth, some of our students had difficulty making connections between their life as undergraduate teachers-in-training and their future careers. Students often struggle putting themselves in the mindset of a classroom teacher and can only guess at what an in-service teacher does to develop professionally. Many of our students at first do not see how Twitter can be useful for a practicing teacher. Although there are many educator role models and experts that PSTs can in theory connect to via Twitter, some of our students have initially struggled to tap into these networks.

Fifth, in the spirit of using Twitter to enhance course content and class conversations, we initially created individual course hashtags (e.g., #EDU355, and so forth), asking students to use the relevant hashtag when tweeting. We eventually realized this approach was limiting. Individual course hashtags were mechanically limiting; some tweets pertain to multiple courses, so adding multiple hashtags is cumbersome. The course hashtag also limited the potential for cross-course and cross-program conversation among peers and faculty and interaction with the larger Twitter community and profession.

Finally, assessment has presented challenges. How can we meaningfully and fairly assess Twitter use from our students? We continually wrestle with what counts as quality Twitter participation, engagement, and collaboration. Does liking or retweeting "count" the same as composing tweets with original content?

Students value clear, transparent assessment criteria for all they do. If PSTs do not feel fairly and accurately assessed on their Twitter work, they may be less likely to buy in and consider future applications.

Recommendations

The challenges described above are representative of all of our classrooms, especially of our early attempts to implement Twitter in teacher education. We have gradually learned from our mistakes and are currently addressing them. We continually tweak assignments, provide more concrete directions, and expand expectations.[1] Below we offer six recommendations for enhancing the use of Twitter in the preparation of PSTs: (1) use an institutional or program hashtag instead of course hashtags, (2) expect a minimum number of tweets per week, (3) suggest who to follow, (4) require participation in chats, (5) use Twitter and resources found via Twitter in class, and (6) invite students to share, reflect, and write about what they learn from their PLN.

Hashtags are a means to navigate and subdivide the many affinity spaces (Gee, 2004) on Twitter. We opt for program and institutional hashtags (#AuburnELA and #ElonEd, respectively) used by students in all of our courses. There are several benefits to this approach. First, the shared hashtag connects students and faculty across courses. Any time students search the hashtag, they can peruse a list of tweets from all PSTs and not just their classmates, which increases learning opportunities and fosters connections beyond the singular course. Second, course hashtags end when the course ends. A program or institutional hashtag, however, continually unites PSTs and faculty, extending the possibility of collaboration and the sharing of resources, even after graduation. Third, a program or institutional hashtag can be used for other purposes beyond courses, like organizing Twitter chats, communicating with local teachers and school districts, and supporting alumni. We have found that one common hashtag broadens how Twitter can be used in teacher education.

Second, consistent with the findings of Junco, Elavsky, and Heiberger (2013), we recommend requiring a minimum number of tweets, usually between two and four per week. While this may sound like micromanaging, we have found that establishing this goal from the beginning increases the likelihood that students will engage earlier and more often. Not having a weekly requirement allows students to delay their participation until the end of the semester. While we do not all necessarily track tweets per week, we use the expectation to remind students to actively engage with Twitter. More importantly, we regularly search our program or institutional hashtag and read tweets from our students. Liking their tweets communicates that we see and appreciate their active participation. It is similarly important to selectively retweet and reply, which acknowledges their effort and insight, and shares their voices with a larger audience.

Third, we provide a list of recommended accounts to follow. Since most students have little experience using Twitter professionally, they need suggestions for building their PLN. If they only follow their classmates and professors, they are not likely to see the value of being on Twitter as they already have other means of communicating with those people. We tell our students to follow at least 30 teachers,

professors, journalists, news outlets, and state and national organizations. It is important for Twitter to not become an echo chamber, so we advise them to follow a variety of accounts that represent multiple perspectives. For example, we recommend students follow both supporters and opponents of charter schools in order to be aware of how and why they disagree. We have recently begun recommending alumni whom our PSTs can follow in addition to in-service teachers in our local school districts; these educators have become a rich resource for mentoring and collaboration beyond what we typically provide for our PSTs.

Fourth, we require participation in chats. The wide variety of existing chat topics allows students the freedom to choose chats that are relevant to their interests and that fit their schedules. For example, #sschat is a vibrant discussion on matters related to social studies that occurs every Monday night at 7:00 pm EST, while #21stedchat is an interdisciplinary and cross-grade level chat that takes place on Sunday nights at 8:00 pm EST.[2] Chats, more than any other activity on Twitter, push PSTs out into larger conversations where they interact with more people, encounter more ideas, and expand their PLN. Such early networking is important given the professional isolation that has often plagued teaching (Lortie, 1975). Although some PSTs have mixed feelings about chats at first—expressing how stressful it can be to monitor the questions, read through multiple answers rapidly, and contemplate how to contribute—they usually get more acclimated with experience. This is why we require them to participate in at least one chat per month during the semester or term. We recommend modeling how Twitter chats work early on, even leading a "slow chat" in order for them to practice using the question-and-answer format and overcome any initial fears.

Fifth, we use tweets and other online resources found via Twitter in class. PSTs need to see Twitter as an integral part of a course instead of supplemental activity they do on their own. There are multiple ways to do this. We invite students to share what they have been reading and learning on Twitter at the beginning or end of class. We take time to share how Twitter has enhanced our own professional development. This includes, for example, sharing screenshots of tweets we find relevant to course content and referencing other resources we have found via Twitter. Furthermore, projecting a list of tweets using the program or institutional hashtag can encourage analytical discussion of exemplar tweets, professional communication, and PLN engagement more generally. On several occasions, we have even invited local teachers who are active on Twitter to be guest speakers in our classes to share their experiences, best practices, and advice. When class has to be cancelled for any reason, we create alternative assignments that require PSTs to use Twitter, like searching particular hashtags, finding tweets and chats related to course content, and tweeting questions to authors of course texts.

Finally, we invite students to share, reflect, and write about what they learn from their PLN. This can happen in multiple ways. While we set some numerical expectations to guide how and how often PSTs use Twitter, we do not merely count tweets and chats to gauge the value of their participation. Instead, we use formative assessments in class in which students write for a few minutes about what they have been reading about and learning on Twitter, as well as a summative assessment at the end of the semester in which students reflect more deeply about the role of PLNs in their continuous improvement

as educators. We even allow students to self-assess their own participation and learning, which we believe aligns with the spirit of teacher-directed professional development.

Conclusion

As explained above, we have experienced challenges in our use of Twitter as teacher educators, but we have also identified practices that have led to improvements in our students' learning and professional experiences with Twitter. Every semester we see evidence that our students learn from others via Twitter in a variety of sometimes unpredictable ways. What they learn is not always planned in the syllabus or directly related to course content, but we have seen them take important steps towards developing their PLNs and taking ownership of their learning. When PSTs have access to broad and diverse professional networks, opportunities for mentoring and growth are multiplied. Moreover, integrating Twitter into teacher education courses provides PSTs with a source for continued learning as they graduate and begin teaching.

There are many educators at all levels using Twitter to solicit and offer advice, share instructional resources and ideas, and improve their practice. We believe that PSTs need to be prepared to learn from and contribute to this discourse, which can facilitate their successful transition into the profession. Because there is a "large gap between Web 2.0 use in [PSTs'] daily lives and in their coursework" (Kumar & Vigil, 2011, p. 144), teacher educators must help PSTs understand the ways that social media such as Twitter can contribute meaningfully to their development. Ultimately, we want PSTs to develop the dispositions and skills necessary to evaluate and identify the digital tools and spaces that can help them grow, thrive, and contribute. This way, each time another technology, platform, or application comes out, they will fully consider how it can support their learning and that of their students.

Notes

1. Examples of Twitter-related assignments that we have used recently with our PSTs are available via a Google document found at the following url: http://bit.ly/twitter_in_ted. We encourage teacher educators to borrow or adapt these assignments as they see fit. We also invite our colleagues to add their own Twitter assignments to the document.

2. A schedule of chats can be found at:
   https://sites.google.com/site/twittereducationchats/education-chat-calendar

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Can Technology Support Teaching for Global Readiness?
The Case of the Global Read Aloud

Jeffrey P. Carpenter and Julie Ellison Justice

Abstract

Technology can create new opportunities for learning *with* and *from* people of other cultures, not just *about* them. The Global Read Aloud (GRA) offers an example of such learning possibilities. The GRA is a project that connects classrooms via digital technologies to discuss common texts. This research explored the pedagogical opportunities and challenges associated with using technology to teach for global readiness in the GRA. Although technology broadened how and with whom GRA students read and discussed literature, the depth and quality of technology-facilitated teaching specifically for global readiness was somewhat unclear. We discuss implications for teaching for global readiness.

Background

Schools have often been understood as serving primarily local needs (Tye, 2009), but globalization has made a narrow regional focus outdated. Advancements in information and communication technologies have reduced the distances between peoples and cultures, and education must accordingly prepare students for a future characterized by globalization (Darling-Hammond, 2010; Walsh, 2016). Reflecting this reality, the International Society for Technology in Education Standards for Students (2016) included a *global collaborator* standard: "Students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally." Various Web 2.0 tools and social media can facilitate changes to when, where, how, and with whom students learn (Krutka & Carpenter, 2016a), as well as expand opportunities for intercultural and collaborative learning (Peters, 2009). Educators today can leverage technology to facilitate students learning *with* and *from* people of other regions and cultures, not just *about* them (Lock, 2015).

This article analyzes the Global Read Aloud (GRA), an example of an approach to teaching for global readiness that utilizes technology (see https://theglobalreadaloud.com/). Created by U.S. teacher Pernille Ripp in 2010, the GRA exemplifies some of the opportunities and challenges for teaching for global readiness in a digital era. Inspired by a radio story about an online book club, Ripp penned a blog post proposing that educators around the globe join their classrooms in the reading and discussion of a common book (Ripp, n.d.). From these simple origins, the GRA has grown in recent years, with classrooms from more than 60 countries having participated.

The GRA takes place during six weeks in October and November. Participating teachers connect their students with peers from other schools to read and discuss a book. While the first year of GRA included only one book, in subsequent years Ripp has selected multiple texts at different levels, and teachers

decide which book is most appropriate for their particular context. In 2015, teachers could choose from four books and one picture book author study (see Table 1). The depth and scope of the collaboration between classrooms depends on the participating educators. For example, some teachers pair with one only class, while others partner with several classes.

Table 1

Global Read Aloud 2015 Book options

Author	Book	Recommended Ages
Amy Krouse Rosenthal	Various picture books (author study)	All
Kevin Henkes	The Year of Billy Miller	Ages 7 and up
Lynda Mullaly Hunt	Fish in a Tree	Ages 9 and up
L.S. Matthews	Fish	Ages 12 and up
Meg Medina	Yaqui Delgado Wants to Kick Your Ass	Ages 14 and up

Ripp does not charge any fees to participants in the GRA. Participants register via an online form, and subsequently receive e-mail updates about the GRA. Prior to the GRA, participants use GRA Edmodo and/or Facebook groups to find partner teachers. Ripp provides a rough reading schedule for each of the GRA books. GRA teachers are encouraged to create, discuss, and share lesson plans, resources, activities, and ideas via the technologies of their choice. Typically, students read and discuss the GRA text both within their individual classes, and with their partner classes. During the GRA, students often communicate via synchronous and asynchronous tools including Twitter, Skype, Padlet, and blogs. Many teachers have their classes engage in at least one videoconference session to meet their partner classes. It is also common for students to respond in writing to blog posts and/or questions created by peers from partner classes.

Theoretical Perspectives

Our lens for understanding the GRA was informed by the construct of teaching for global readiness as defined by Kerkhoff (2017). Drawing upon theories of *educational cosmopolitanism* (Hansen, 2010; Hull & Stornaiuolo, 2014) and *multiliteracies* (Cope & Kalantzis, 2000; 2009), Kerkhoff (2017) defined global readiness as "global citizenship with the multiliteracies necessary in the 21st century to participate, collaborate, and work in a global society" (p. 92). Educational cosmopolitanism recognizes universal values, emphasizes critical global citizenship, and encourages open-mindedness and tolerance. Pedagogies that address multiliteracies recognize and embrace the multimodal nature of many modern

texts, as well as the diverse needs and assets of students. Teaching for such a vision of global readiness is a complex endeavor and Kerkhoff's research suggests it includes at least four elements: situated practice, integrated global learning, critical literacy instruction, and transactional experiences. These four elements of teaching for global readiness provide a helpful lens for considering the opportunities and challenges associated with the use of technology in the GRA.

Situated practice refers to teaching and learning that responds to the contextual nature of learning by attending to the people and place involved. Such practice is relevant, authentic, and social. Situated practice considers the community within the classroom as well as the society within which learning occurs. To be able to respond to their context, teachers must build relationships with students, and seek to understand them as social and cultural beings.

In order to further global readiness, educators design curriculum and instruction that features *integrated global learning*. Global education should not feature as an extra or special activity, but instead be integrated across grade levels and disciplines. Teachers connect global learning to existing curricula and local matters. Teaching for global readiness demonstrates how the local is already global, and helps students understand how communities around the world are interconnected and interrelated.

Teaching for global readiness also requires the development of students' *critical literacy*. Educators who teach critical literacy utilize texts from multiple perspectives and help students learn to analyze and evaluate those various perspectives. Kerkhoff sees critical literacy as helping students to "develop the capacity to question the authority of the source of information, analyze the authors' purposes, and locate primary sources" (p. 103).

Finally, *transactional experience* refers to exchanges of perspective through "reading, writing, listening, speaking, and inquiry experiences … with diverse others" (p. 103). When students engage in firsthand cross-cultural discussions, they can learn from each other's perspectives. Such direct experiences, be they face-to-face or virtual, are considered essential to the development of intercultural competency. For these firsthand learning experiences to be most beneficial, students must exchange information and ideas with others in ways that require give-and-take from all sides.

Literature Review

Education for Global Readiness

The GRA came into being during a time of keen interest in global education (Hull & Stornaiuolo, 2014; Kerkhoff, 2017). As economies and societies evolve in response to a more interconnected world, the need for schools to prepare global-ready students is apparent (Walsh, 2016). However, consensus is lacking regarding the appropriate goals for a more global educational approach (Peters, 2009; Reynolds, 2015). Different arguments for global education emphasize the importance of preparation for global economic competition, the need for learners to develop "world minded" ways of thinking (Merryfield, Lo, Po, & Kasai, 2008), and the imperative to educate citizens who engage with global issues

(Harshman & Augustine, 2013; Leduc, 2013). Lim (2008) suggests that global education "Should be concerned with more than developing international awareness or a more rounded person; it is also about rights and responsibilities, and duties and entitlement" (p. 1074). The disparate visions of education for global readiness are further muddled by the use of the term *global* in some cases to signify corporatization or Americanization.

In addition to the absence of clarity regarding purpose, education for global readiness is complicated by other factors including the controversial nature of some global education topics, difficulties with integrating global content into local curricula, and the limited international experience of many educators (Reynolds, 2015; Tye, 2009). Educators must teach for global readiness in ways that counteract potentially ethnocentric or paternalistic attitudes (Leduc, 2013). Global education activities should engage students in critical thinking about global relationships, power dynamics, and systematic inequalities, and situate these matters in relation to local issues. In sum, while there is consistent support for the value of educating for global readiness, it remains a complicated and contested endeavor.

Technology's Roles in Education for Global Readiness

Historically, constraints of time and place have affected the kinds of learning activities students experience in their schools. However, new possibilities have emerged as Web 2.0 technologies have lessened temporal and geographic obstacles (Carpenter & Krutka, 2014; 2015; Carpenter & Green, 2017; Greenhow & Gleason, 2012; Krutka & Carpenter, 2016b). Students need not travel abroad to engage in meaningful cross-cultural transactional experiences (e.g., Leask, 2004; Lindsay & Davis, 2013). Lock (2015) recently suggested that "connecting, communicating, collaborating and creating knowledge with others beyond our local communities have never been more attainable than we are currently experiencing in today's digital world" (p. 140). Digital technologies have facilitated interactions with distant peers that have reportedly led to increases in students' cross-cultural awareness (Krutka & Carano, 2016), decreases in their ethnocentrism (Union & Green, 2013) consciousness of their own misconceptions (Pitts & Brooks, 2016), and greater awareness of their own identity and culture (Myers & Eberfors, 2010). New technologies also provide learners greater access to experts and diverse forms of expertise (Lock, 2015).

Prior research has described multiple cases of paired higher education classrooms in two different countries interacting over the course of a semester (e.g., Kinchin & Bryant, 2015; Pitts & Brooks, 2016). For instance, Krutka and Carano (2016) studied the experiences of students from the Gaza and the United States (*N*=16) who utilized Skype and Facebook to interact. These technologies reportedly created spaces for humanizing dialogue. For the U.S. students, the opportunity to talk directly with their Gazan counterparts raised their awareness of the human implications of global events; matters in faraway lands "no longer felt like foreign issues because these conflicts involved people who were now near and dear to their heart" (p. 216). Examples of successful small-scale projects that leverage technology to connect K-12 learners have also been documented in the literature (e.g., Barnatt, Winter, Norman, Baker, & Wieczorek, 2014; Union & Green, 2013).

Technological affordances alone do not, however, guarantee the success of global teaching collaborations. Pitts and Brooks (2016) suggested that global education produces the most benefits when learners are "guided through a controlled process of self- and cultural-awareness" (p. 13). The extant literature warns that educators must avoid pitfalls commonly associated with global collaboration. Mere exposure to global opportunities does not inevitably enhance global readiness (Leask, 2004). Learners must critically examine positions of privilege and challenge *us vs. them* binaries, and consider how differences in the relative power of their respective countries or cultures could affect interactions (Sancho, 2008).

Prior research also suggests educators should avoid one-off learning "events" that are not integrated with regular curriculum. While such events can be gratifying, educators "can get caught up in the excitement … and enthusiasm" (Pitts & Brooks, 2016, p. 13) and fail to push students towards critical reflection and self-awareness (Harshman & Augustine, 2013). Education for global readiness requires sustained learning experiences that can more profoundly affect learning and skill development (Lock, 2015). More sustained forms of global education can allow educators to negotiate differences regarding teaching and learning, as colleagues from different cultures will sometimes have contrasting expectations and perspectives.

Many educators lack relevant personal experiences from their own schooling to inform their teaching for global readiness (Leask, 2004). And while digital technologies can enable new global education activities, some teachers do not have access to those technologies and/or the necessary technology support (Leduc, 2013). Technology thus appears to create both opportunities and challenges for teaching for global readiness. Furthermore, the prior research that has explored education for global readiness has been limited by the small scale of many of the studied interventions, and the paucity of studies in PK-12 settings (Cushner, 2012). Research on a program of the GRA's scale and nature has been missing from the literature.

Method

Research Questions

This study sought to contribute to understanding of the pedagogical possibilities arising from organic, technology-intensive global teaching and learning initiatives. The research questions were as follows:

RQ1. What opportunities for teaching for global readiness are associated with the uses of technology in the GRA?

RQ2. What challenges for teaching for global readiness are associated with the uses of technology in the GRA?

Instrument

We designed an anonymous online survey that collected data regarding participating educators, their experiences with the GRA, and their perceptions of said experiences (Appendix A). The survey included 27 items split between three parts: informed consent, demographics, and GRA-related items. The survey had open-ended, close-ended, and Likert scale items. We shared an early draft of the survey with the GRA's creator, and three GRA participants from prior years, and revised the draft based on their feedback.

Data Collection

Upon the conclusion of GRA 2015, we solicited responses to the survey during the following five weeks. Pernille Ripp included a link to the survey in an e-mail sent to the educators who registered for the GRA. We posted multiple survey invitations to social media sites commonly used during the GRA. We sent invitations via Twitter, and included GRA-related hashtags (#). And we posted invitations to the main Edmodo groups that were created as collaboration spaces for teachers working with the different GRA 2015 books. Across the different online spaces, we distributed invitations at various times and days of the week to make the survey visible to potential participants in different time zones and with varied online habits.

Sample

Five hundred sixteen participants representing 14 countries responded to the survey, with the vast majority coming from the United States and Canada (Table 2). Ninety-five percent of these educators were females, while 5% were males. The largest group of respondents was those aged 40-49 years, who represented almost a third of participants (Table 3). In terms of prior experience, 59.4% of respondents were participating in the GRA for the first time in 2015. Almost three-quarters of the respondents were regular education teachers, with librarian / media specialists comprising the second largest group of participants (Table 4). While almost 38% of the respondents were the only individuals in their schools who took part in the GRA, the majority of respondents had colleagues from their school involved with the GRA, including 7.4% of respondents who had 10 or more GRA participant peers in their schools. Participants worked with students as young as two to as old as 20, but most commonly taught learners aged 7 to 11.

Table 2
Participant Country of Residence

Country	Count	Percentage of Respondents
United States	374	76.2%
Canada	89	18.1%
Australia	9	1.8%
New Zealand	7	1.4%
United Kingdom	3	0.6%
Afghanistan, Albania, Argentina, Barbados, Japan, Poland, Serbia, Spain, Turkey	1 each	0.2% each

Table 3
Participant Age

Age	Count	Percentage of Respondents
20-29	49	9.5%
30-39	149	28.8%
40-49	165	32.1%
50-59	123	23.9%
60 or older	29	5.6%

Note: Percentages do not sum to 100% because of rounding.

Table 4
Participant Professional Role

Role	Count	Percentage of Respondents
Regular education classroom teacher	382	74.5%
Teacher librarian / media specialist	48	9.4%
Instructional technology facilitator or other technology integration role	17	3.3%
Literacy or reading specialist	15	2.9%
Special education teacher	14	2.7%
Instructional coach	5	1.0%
Other	30	5.9%

Table 5
Response to "Indicate your agreement with the following statement"

Question	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
I am a frequent user and early adopter of technology in my teaching.	n=10 2.1%	n=13 2.7%	n=49 10.1%	n=169 34.9%	n=244 50.3%
Apart from the GRA, I facilitate global connections for my students.	n=47 9.7%	n=136 28.0%	n=97 20.0%	n=117 24.1%	n=88 18.1%

The GRA appeared to be both similar to and different from the teaching and learning activities the participants typically provided to their students (Table 5). Given that 85.2% of the participants self-identified as early adopters and frequent users of technology in their teaching, it seems likely that their students were accustomed to some integration of technology into teaching and learning activities. However, fewer than half of the participants (42.2%) reported that outside of the GRA they facilitated global connections for their students.

Data Analysis

This article is based primarily on the qualitative survey data, although descriptive statistics also informed the overall analysis. We engaged in a thematic analysis of the qualitative data with the goal of identifying and exploring patterns and themes. We followed a six-phase process of thematic analysis defined by Braun and Clarke (2006): becoming familiar with the data, generating initial codes, searching for themes, reviewing themes, defining themes, and producing a report. To familiarize ourselves with the data and generate our initial codes, we conducted repeated cycles of individual coding followed by discussion of similarities and differences of interpretation. We conducted eight such cycles of coding. Due to the interpretive nature of the qualitative coding in which we engaged, we relied upon intensive discussion to reach agreement on codes, rather than on an interrater reliability statistic (Saldaña, 2016).

We independently read and reread the first 100 survey responses to look for patterns and develop tentative codes. We compared our initial analyses, and through discussion, comparison, and consolidation identified a tentative coding structure that included 53 different codes. We then synchronously coded and discussed the next 100 responses. We grouped and compared data receiving the same codes both to refine our definitions of the codes and to compare and contrast responses. This collaborative coding and discussion led to consideration of various approaches to interpreting the data (Saldaña, 2016; Sandelowski & Barroso, 2007).

Next, we individually coded the remaining survey responses. After again comparing our coding to reconcile differences of interpretation, we reconsidered the overall code structure. This resulted in the deletion of two codes, and a final set of 51 codes. The full set of responses was again read and coded with the finalized code set. After coding, we prepared summary reports for each qualitative prompt that included data exemplars for

each code and analysis of code frequencies. After discussion of these individual reports, we identified themes that spanned across various survey items and codes. We then revisited our individual reports in light of these themes, before shifting to the writing of the holistic analysis of results.

Results

In general, participants reported quite positive perceptions of the GRA (Table 6). In their overall GRA rating, almost 65% of respondents selected "Outstanding" and 33.2% chose "Good." Participants also overwhelmingly (96.5%) reported that they were interested in participating again in the GRA. In the context of these overall positive perceptions, we will consider below opportunities and challenges for teaching for global readiness associated with the uses of technology in the GRA.

Table 6

"Rate the overall Global Read Aloud 2015 experience for you and your students."

Answer	Count	Percentage of Respondents
Outstanding	308	64.7%
Good	158	33.2%
Fair	8	1.7%
Poor	2	0.4%

RQ1. What opportunities for teaching for global readiness are associated with the uses of technology in the GRA?

Analysis of the data most clearly indicated that technology created opportunities for *transactional experiences*. Participants described a number of ways in which digital tools facilitated student engagement in reading, writing, listening, and speaking experiences with peers from beyond their own schools and districts.

Videoconferencing with partner classes appeared to be a common and valued transactional experience during the GRA. Just under 80% of the respondents reported that their students used one or both of Skype or Google Hangouts for videoconferencing with another GRA class. Twenty-nine respondents used the word "love" or "loved" to describe student feelings about GRA videoconferencing. Videoconferencing was frequently mentioned as a motivational aspect of the GRA experience. For example, a U.S. middle-school media specialist commented, "The students were able to interact with other students in Canada; it helped to motivate them [students] to create questions and respond to the other students' blogs." Videoconferencing was also credited with contributing to the quality of the connections that occurred during the GRA, as can be seen in the following participant comments:

> "It seemed to impact the students the most when they were able to see the people they were participating within the program."

> "The students were able to interact with other students in Canada; it helped to motivate them to create questions and respond to the other students' blogs."

By allowing partner class peers to see each other and interact more directly, videoconferencing appeared to support overall engagement with the GRA.

In particular, "Mystery" Skype and Google Hangout calls were mentioned by 11% of respondents as an important part of the GRA experience for students. In mystery videoconference calls, the teachers of the two classrooms calling each other have planned the experience and are aware of each other's locations, but the students do not initially know where their peers are. Classes alternate asking each other questions in order to try to figure out their respective locations. A Canadian elementary school teacher commented, "It showed my students that you can connect with the world, with students anywhere and discuss a book."

In addition to synchronous videoconferencing experiences, participants described the use of various digital tools to support asynchronous transactional experiences. Asynchronous communication mitigated some of the challenges that typically hamper collaboration between distant classrooms. Students could post their questions and comments about the GRA books, and receive feedback whenever their partner classes or other participants were online. For example, two respondents described how Twitter and Padlet helped overcome scheduling challenges:

> "We were able to connect with lots of classes around the world. The time difference doesn't matter. [Twitter] is quick and replies are quick."

> "Padlet allowed us to discuss and interact without worrying about schedules and time zone differences"

Several Padlets were widely shared during the GRA, and sparked responses from classes that were not officially partnered. The widespread use of several GRA-related Twitter hashtags also meant that students' GRA tweets regularly attracted responses.

Digital tools including Edmodo, Google Drive, Kidblog, and Writeabout allowed for extended writing and discussion related to the GRA texts. In contrast to the public nature of Twitter and Padlet, these technologies offered more student privacy and teacher control. Numerous participants described GRA activities that involved students regularly posting their perspectives on their reading to a common online space where peers from partner classes would respond. Students would in turn read and respond to posts from their partner classes. Technology thus gave students a wider audience with which to share their thinking and from which to receive feedback. A second grade teacher wrote that it "was powerful for my reluctant readers and writers to see their ideas shared with others." Another participant commented, "[Students] were very interested in reading other students' ideas or predictions about the books and felt very proud when someone responded to their own."

Approximately one-fifth of participants referred to using technologies in combination to facilitate transactional experiences. For instance, one teacher wrote, "I felt that the Kidblog offers an ongoing connection with another class, but the Google Hangout was powerful in that we could see the other students," and another participant explained, "One of my classes used Skype to be part of two mystery Skype sessions. They also connected with that same class in Canada with Kidblog. They enjoyed being able to see the other kids they were communicating with." By providing avenues for synchronous and asynchronous communication, and supporting both initial and ongoing connections between participants, technology expanded the possibilities for how and with whom GRA students exchanged perspectives through reading, writing, listening, and speaking experiences.

Although not as prevalent as descriptions of transactional experiences, the data did include instances of *integrated global learning* related to the GRA. Various participants identified ways in which the GRA connected to their overall curriculum, and did not function as an entirely isolated unit of instruction or special event. For example, one teacher described a Skype session with a class in Australia "where we discussed not only the book, but also made science and geography connections with the other class. It was wonderful to have a meaningful connection that included the book but also went beyond the reading." A respondent who had participated in the GRA for multiple years commented, "The impact of the book and connections leave a mark throughout all subject areas as we often refer back to the book," and another GRA veteran wrote, "The connections to others bring in so many other learning opportunities in every curriculum area." Several respondents anticipated using technology to continue their interactions with their partner classes beyond the GRA, making comments such as the following:

> "[The students] are now pen-pals with the class I partnered with and we are continuing our relationship via writing and through the use of technology."

> "There was overall enthusiasm for dialoguing with our Canada friends. We even hosted the Canadian teacher in Florida during her spring break. It is a tie that will last forever."

A handful of respondents specifically mentioned connecting GRA activities to social studies standards and geography content. Multiple participants mentioned how videoconferencing piqued their students' interests regarding the locations of partner classes, making comments such as the following:

> "Several of my students want to research the places we've Skyped with."

> "The mystery Skype got them really excited about map skills."

> "They've also become more interested in connecting with other students globally and learning about other countries."

In some cases, teachers appeared to recognize opportunities for integration of the GRA with their overall curriculum during or after the GRA, rather than having planned in advance for such integration. For example, one U.S. participant wrote, "I hope to extend our learning with some geography lessons as a result of the postcards we received," while a Canadian teacher commented, "We still have much to do with this event even though it is technically wrapping up. I feel like it is the beginning of many things."

RQ2. What challenges for teaching for global readiness are associated with the uses of technology in the GRA?

Although technology appeared to create opportunities for teaching for global readiness in the GRA, our data suggested that challenges were also experienced. Participants most commonly mentioned encountering challenges related to *integrated global learning*. Almost one-third of respondents (32%) identified curricular barriers they experienced during their implementation of the GRA. The two most frequently mentioned curriculum challenges to the integration of the GRA with other content and local matters were time pressures and the rigid nature of curriculum. Many participants mentioned feeling that they lacked sufficient time to give the GRA the full attention it deserved. For instance, one participant commented, "I would have loved to do even more with it than I did but other curricular demands wouldn't allow it," while another educator wrote, "I wanted to spend a lot of time on it, but that of course takes away from other necessary instructional time."

Participants noted how pacing guides, standardized testing, and curricular mandates competed with their desire to dedicate time to the GRA. A teacher wrote, "We are tasked with an immense number of things we must accomplish each day, combined with the ever-present push of standardized testing almost every four weeks." Another respondent saw opportunities to "teach the weekly grammar, phonics, fluency, writing, and comprehension skills and strategies required in our reading curriculum through the GRA books," but could not do so because "our time and what we teach is typically very dictated to us." This educator was thus reduced to "trying to squeeze in these extra [GRA] lessons." A second respondent used similar language in describing obstacles to the integration of the GRA with her regular curriculum:

> We have pacing guides for every subject area and I was challenged with finding the time to squeeze in the activities. I know how much more valuable the GRA is compared to many of our requirements but I often felt guilty for allowing my students extra time for activates related to the GRA.

While technology created possibilities for new kinds of teaching and learning activities during the GRA, some teachers found it difficult to integrate the GRA with their existing curricula. When the GRA felt like an extra or special activity, rather than a part of the regular curriculum, other curricular demands made many respondents feel they could not dedicate sufficient time to the GRA. Policies around curriculum may therefore have limited opportunities for teachers to use technology to teach for global readiness during the GRA.

Participants also reported challenges associated with trying to use technology to facilitate *transactional experiences* during the GRA. The most commonly mentioned obstacle to transactional experiences was time zone differences that complicated attempts to participate in synchronous videoconference activities. For example, a teacher from Australia wrote, "Unless it's a New Zealand school we have next to no chance to Skype people." Other similar comments included the following:

> "I would have loved to connect overseas but the time difference makes it difficult."

> "It is hard to collaborate with other teachers in different time zones and with different school schedules! Teaching is a tough enough business, and to organize a collaboration is a huge extra task!"

Schedules sometimes presented a more general challenge to GRA partnerships between classrooms, with school systems in different regions and countries featuring varied class period and term lengths, as well as observing different holidays. For example, teachers could not as easily engage their students in transactional experiences with far-flung peers in the following scenarios:

> "Our school schedule did not align with the GRA. We had standardized testing and a fall break that interrupted our reading."

> "We start in late July and end 1st quarter in late September or early October, right when GRA starts. Because of this, for the past four years, we've been playing 'catch up' the first week we return for second quarter. We aren't able to connect with schools from the very start of the book."

Some GRA participants thus faced various obstacles in coordinating the synchronous and/or asynchronous technology-facilitated interactions that appeared to be so beneficial for many GRA students.

Some participants also directly mentioned policies around technology as presenting challenges during their GRA experiences. A handful of respondents reported that regulations or administrator decisions had prevented them from using particular digital tools during the GRA, including Skype, Edmodo, Kidblog, and Write About. One participant explained, "I wasn't allowed to blog outside of an approved platform," and another said of her administrators, "They fear private information being used and children being placed at risk."

Discussion

Our findings describe educators' perceptions of pedagogical opportunities and challenges associated with a technology-rich approach to global education. The technologies used in the GRA demonstrated the potential to bridge divides between people by enabling the sharing of different perspectives across time and space. The GRA appeared to expand spaces for transactional learning experiences beyond the physical classroom. Our findings related to the role of videoconferencing in the GRA align with previous studies that have described the contributions videoconferencing can make to social presence and community building in cross-cultural projects (Krutka & Carano, 2016; Wang, 2011).

The GRA demonstrates how technology can support a low-cost, participant-driven initiative that opens up more classrooms to direct interaction with diverse peers. However, it was apparent that participants experienced both opportunities and challenges as they sought to integrate GRA transactional experiences with their regular curricula. While the GRA is designed to allow participating teachers a great deal of flexibility, the contexts within which participants work may include more rigid expectations. Technology appeared to help empower teachers to self-organize and customize the GRA to meet their and their students' needs, but some teachers still faced certain requirements that complicated their efforts to take

full advantage of the GRA. In some cases, curricula and associated mandates may not be keeping up with the pedagogical possibilities offered by new technologies.

The participants' responses to our survey left it somewhat unclear how technology was utilized to support situated practice and critical literacy instruction. Few participant comments addressed either opportunities or challenges associated with these aspects of teaching for global readiness. Considering that almost 60% of the respondents were first time GRA participants, it may be that many teachers were not yet experienced enough with the GRA to pursue instruction that included more attention to situated practice and/or critical literacy. For example, teachers who were partnering their classes for the first time may not have felt immediately comfortable or knowledgeable enough to tackle potentially thorny issues related to critical literacy. While technology might make it fairly easy for two partnered classes to engage in an introductory Mystery Skype call, their teachers might feel less equipped to lead Skype discussions among their students that might touch upon, for example, a past conflict in which the countries of the partnered classes were on opposing sides or a contentious contemporary issue that might spur strong disagreements between students. Other GRA teachers could require guidance on how to engage more with the diversity that exists within their own schools and local communities (Charles, Longerbeam, & Miller, 2013).

Digital technologies can be a double-edged sword, providing new opportunities for teaching and learning, but also asking more of teachers (Meabon Bartow, 2014), and the GRA appears to be a project in which this is the case. More professional development and support could be necessary to help maximize the benefits of projects such as the GRA. For instance, while one participant might need help with the technical features of a certain videoconferencing tool, a second participant could instead require support in order to engage students in meaningful dialogue during a videoconference session, and a third might need assistance in reflecting upon cultural differences that emerged during a videoconference session. In the absence of such supports, there is a real possibility that GRA activities could in some cases actually negatively affect students' global readiness. Instead of broadening students' worldviews, interactions with those perceived as *other* can potentially lead to the entrenchment of existing stereotypes (Pitts & Brooks, 2016). Educators must therefore be thoughtful in how they utilize the opportunities for cross-cultural contact provided by technology, and should reflect upon areas in which they may need to expand their own professional knowledge and skills.

Limitations

This research is limited by its reliance upon convenience sampling and a self-report survey. Participants may not represent trends in the general educator population, and were possibly among the more enthusiastic GRA participants. Educators who experienced intense challenges may have failed to complete the full GRA program and would thus have been likely to see or respond to our end-of-program survey. The fact that participants were overwhelmingly from the United States and Canada could also limit the applicability of these findings to the experiences of teachers in contexts outside of North America.

Implications for Practice and Research

Despite its limitations, this research has implications for the field and suggests potential topics for future research. Given the generally positive participant experiences, educators interested in teaching for global readiness may want to consider participating in future GRAs. Educators who do participate in future GRAs should consider how they best integrate the project with the rest of their curriculum in a situated and critical fashion. It is likely, however, that many educators will need support as they seek to manage such interactions, particularly educators who are not as tech-savvy and globally minded as our participants. Participants will require multifaceted and individualized support to meet their varied pedagogical, technological, and content area needs. Curriculum facilitators might help teachers determine how to integrate experiences like the GRA with existing curriculum mandates. Teacher educators also should consider how best to prepare the next generation of teachers to take advantage of and even create opportunities such as the GRA.

Research that compares organic, teacher-led initiatives like the GRA with more structured global education programs that are run by nonprofit, for-profit, and government-supported organizations would also benefit the field. Future research might study whether and how GRA participation affects teaching and learning after the program. For example, does GRA participation lead teachers to integrate more global approaches throughout the remainder of the school year? Research could examine cases in which classes partnered during the GRA subsequently collaborate in additional ways, or study partnerships between teachers that have spanned multiple GRA iterations. Measures other than teacher self-report surveys could provide more accurate understanding of how projects such as the GRA affect student achievement and global readiness. Asking students directly about their GRA experiences could yield more insight into how students' experience such cross-cultural projects. Researchers might explore the experiences of GRA teachers at schools with large numbers of participating educators and students. Such clusters of teachers may have quite different experiences than individual educators who could be hindered by the absence of local administrative support for a bottom-up innovation like the GRA (Petko, Egger, Cantieni, & Wespi, 2015). Finally, future studies could also delve into how projects such as the GRA might tap the potential for text-to-speech and translation technologies to work in concert to support cross-cultural understanding among learners who lack a common language (e.g., Lewis, 2015; Shadiev & Huang, 2016).

Conclusion

Students today must interact with different cultures and global issues if they are to become the responsible citizens the world needs. New approaches to teaching and learning that develop students' global readiness are needed, and technology has shown the potential to make the "other" feel less distant and foreign. Technology can extend the possibilities for learners to share their perspectives, and co-construct knowledge and understanding with far-flung peers. One-book, one-school programs have encouraged the shared reading of books across classrooms, but technology has allowed for the expansion of such activities to an even larger scale in the GRA. However, while digital tools may offer possibilities for

teachers to welcome the world into their classrooms, the new experiences technology can facilitate also bring with them certain curricular and pedagogical challenges.

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Appendix A

Survey Items

Including Global Read Aloud 2015, how many times have you and your students participated in the Global Read Aloud?

Including yourself, how many **teachers** at your school participated in the Global Read Aloud 2015?

How did you and your class read the book? (Please check all that apply).
　　　　We read aloud with another class using a video conferencing service such as Skype, Google Hangout, Facetime, etc. (1)
　　　　Teacher read aloud to the whole class during class time. (2)
　　　　Children read aloud to each other, within their own class, during class time. (3)
　　　　Children read silently on their own. (4)
　　　　Parents were expected to read to children at home. (5)
　　　　Other (6) _____

Please indicate technologies your students utilized as part of their Global Read Aloud 2015 activities.
　　　　Twitter (1) Edmodo (2) Skype (3) Google Hangout (4) Google Drive (5) Instagram (6)
　　　　Padlet (7) Writeabout.com (8) Tackk (9) Sway (10) Kidblog (11) Goodreads (12) Voxer (13)
　　　　Email (14) Flipgrid (15)
　　　　Other (16) _____

Which technology was most important to your students' GRA experience? Why?

Please indicate technologies you, the teacher, utilized as part of your organization, planning, and teaching of the Global Read Aloud 2015. (Check all that apply).
          Twitter (1) Edmodo (2) Skype (3) Google Hangout (4)
          Google Drive (e.g., Google docs, forms, sheets) (5) Voxer (6) Writeabout.com (7)
          Facetime (8) Email (9) Facebook (11)
          Other (10) _____

Which technology was most important for you? Why?

Please indicate your degree of disagreement or agreement with the following items.

	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
My students are generally highly motivated and engaged. (1)	○	○	○	○	○
My students were highly motivated and engaged during their Global Read Aloud (GRA) 2015 activities. (2)	○	○	○	○	○
My students liked the GRA book. (3)	○	○	○	○	○
My students liked interacting with students from other schools as a part of the GRA. (4)	○	○	○	○	○
I am a frequent user and early adopter of technology in my teaching. (5)	○	○	○	○	○
I consider literacy and/or reading instruction one of my strengths as a teacher. (6)	○	○	○	○	○
I read aloud to my students frequently. (7)	○	○	○	○	○
Apart from the GRA, I collaborate with educators outside of my school. (8)	○	○	○	○	○

Apart from the GRA, I facilitate global connections for my students. (9)	O	O	O	O	O
The GRA is similar in nature to other teaching and learning experiences I provide for my students. (10)	O	O	O	O	O

Rate the overall Global Read Aloud 2015 experience for you and your students.
      Poor (1)
      Fair (2)
      Good (3)
      Outstanding (4)

Will you participate in future Global Read Alouds?
      Yes _____
      No _____
      Unsure _____

Why did you participate in the Global Read Aloud 2015?

How did the Global Read Aloud 2015 impact your students' learning?

What was the biggest obstacle or challenge you faced with the Global Read Aloud 2015?

Tell us your favorite moment from your and your students' participation in the Global Read Aloud 2015.

What changes or improvements would you recommend for the next Global Read Aloud?

Teachers' Experience Using Technology to Provide Feedback That Enhances Students' Persuasive Writing Skills

Maria Cutumisu, Chantal Labonté, Vanessa Oslie, Elizabeth Gange, Heather M. Brown, and Veronica R. Smith

Abstract

This study explores the implementation of technology to facilitate students' persuasive writing skills within elementary school classrooms. Five teachers were interviewed regarding their experiences teaching persuasive writing to students using technology-mediated feedback. Teachers perceived the influence of technology on students' persuasive writing, on their own teaching practice, and on students' experiences as valuable for skill development for both themselves and for their students. However, students' unfamiliarity with technology was at times a hindrance.

Background

Persuasive Writing

Writing well is a necessity for students to achieve academic and professional success. Specifically, skilled persuasive writing predicts academic success and is a basic requirement for participation in civic life and in the global economy (Graham & Perin, 2007). However, few teachers feel adequately prepared to teach persuasive writing effectively, mostly because the process of teaching these skills involves several resources and steps rarely available in an average classroom. For example, to facilitate good writers, teachers need to teach the grammar of persuasive writing (i.e., organization and structure; Midgette & Haria, 2016), provide feedback on several written drafts (Schwartz, Tsang, & Blair, 2016), and encourage deliberate practice through the revisions of written drafts (Ericsson, Krampe, & Tesch-Romer, 1993).

Technology for Writing

Technology is increasingly acknowledged for its ability to support and promote writing development in a multitude of ways. Internet-based applications, such as blogs, wikis, and social networking sites, and mobile educational applications, including apps that teach content, are designed to be embedded within classroom instruction (Karchmer-Klein, 2013). Online cloud-based technologies with open-editing and review features have been used to promote collaborative writing and exchange of feedback among students (Suwantarathip & Wichadee, 2014; Zheng, Lawrence, Warschauer, & Lin, 2015), while word-processing and assistive features have been used to support the writing development of students with a variety of cognitive abilities and learning needs (Smith, 2016).

Maria Cutumisu, Chantal Labonté, Vanessa Oslie, Elizabeth Gange, Heather M. Brown, and Veronica R. Smith

Students' Attitudes Towards Writing With Technology

Students generally feel positive about using technology to support the writing process, yet there is mixed evidence that doing so improves their writing overall. In one study, Grade 6 students reported positive attitudes towards using Google Docs to write and exchange feedback; however, the quality of students' writing did not improve following the intervention (Zheng et al., 2015). In a second study, one group of undergraduate students collaborated on writing assignments using Google Docs, while the control group wrote collaboratively in face-to-face groups. The technology users reported positive attitudes toward collaborative writing, high levels of collaborative learning, and a favourable perception of Google Docs as a learning tool. Additionally, students who used Google Docs achieved higher levels of achievement on their writing assessments on average compared to controls (Suwantarathip & Wichadee, 2014).

Students' Skill Improvement in Writing With Technology

A recent study looked more closely at how technology may support the writing process. Smith (2016) asked students to write two narrative texts: one with a technology (i.e., spell check, speech-to-text, word prediction, and *Read and Write* for Google) and one without technological support. They found that, when using word-processing tools, the students' overall score on their narrative text improved, regardless of whether the student had significant learning needs or learning strengths. More specifically, students with complex learning needs used more sophisticated vocabulary, made less spelling errors, and wrote higher quality texts. Similarly, the narrative writing of students described as gifted or talented was significantly longer in length, contained more complex sentences, and was of significantly better quality as measured by grade level compared to their writing without the use of technology. These results suggest that technology can positively contribute to students' writing development for both high- and low-achieving students, particularly in inclusive learning environments (Smith, 2016).

Feedback and Technology for Persuasive Writing

Technology can support student writing beyond word-processing tools. For example, technology can facilitate immediate access to student writing with the purpose of providing timely feedback. Feedback has been identified as a common yet important pedagogical practice across all subject areas, including writing. It is defined as "information that flows back to learners about the quality of their ideas and behaviours" (Schwartz et al., 2016, p. 64). Feedback can be directive by telling the student what needs to be fixed, or it can be facilitative by providing comments and suggestions to guide the students in their own revision. Both types of feedback can have a scaffolding effect on students' learning. Directive feedback can be utilized in the early stages of learning, while facilitative feedback can be used when the learner has developed an understanding of the subject matter (Shute, 2008).

In order for feedback to be most helpful, research has made several recommendations focused on the content of the feedback itself. If feedback is delivered at the right level (i.e., directed to the task,

rather than to the learner), it can help students to understand, engage, or develop effective strategies for reaching their learning goal (Hattie & Timperley, 2007). Effective feedback should be specific to help the learners take steps to reduce the discrepancy between their desired goal and their current performance. Second, feedback should be timely to enable learners to determine what led them to the error. Third, feedback should also be understandable for the learner, so that the learner can determine what to do to correct errors. Fourth, feedback should be delivered in a nonthreatening way. Finally, feedback should trigger the learner to revise and correct errors (Schwartz et al., 2016).

Other research has focused on the timing of the feedback. Feedback needs to be provided to the learner almost immediately, while the learner is still completing a task (Van der Kleij, Feskens, & Eggen, 2015). Immediate feedback has been associated with faster gains, greater success on difficult tasks, and better retention of procedural and conceptual knowledge, especially for struggling learners (Shute, 2008). Researchers who examined the effect of feedback timing found that students who received feedback within approximately 20 minutes of finishing their assignment significantly outperformed students who received feedback within 24 hours. Thus, timing of feedback is an important factor for student success (Kulkarni, Bernstein, & Klemmer, 2015).

Teachers' Attitudes Towards Technology as a Pedagogical Tool

Studies examining the relationship between technology and student achievement suggested that the impact of technology on student learning depends on the attitudes and beliefs of the teacher (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Jonassen, Howland, Marra, & Crismond, 2008; Twyman & Sota, 2016). When a teacher endorses a positive attitude towards technology, the likelihood of technology being used by students in the classroom increases. In the same way, when teachers feel competent and believe in their ability to use technology, students' use of technology in the classroom also increases. In contrast, a lack of technology support and accessibility discourages teachers from using educational technology within their classrooms (Buabeng-Andoh, 2012). Other common barriers to using technology in the classroom include teachers' resources, training, knowledge and skills, as well as attitudes and beliefs (Ertmer et al., 2012). Nevertheless, teachers play a pivotal role in the uptake of technology in the classrooms, more so than the provision of adequate resources.

Purpose of the Study

Teachers' perspectives are vital to ensure the success of writing interventions. The purpose of this study was to explore the perspectives of teachers with regards to the impact of technology on their teaching of persuasive writing with feedback, as well as their students' learning experiences. We focus on a subset of five teachers, from a larger sample, who shared their perceptions regarding the influence of persuasive writing with technology on their own teaching practice and on their students' writing experiences.

Maria Cutumisu, Chantal Labonté, Vanessa Oslie, Elizabeth Gange, Heather M. Brown, and Veronica R. Smith

Methodology

Research Context

The current study is situated within a larger mixed-method community-based research study design (i.e., a collaboration among Alberta Education, the University of Alberta, and two school jurisdictions). Community-based participatory research promotes 1) power sharing in decision making, 2) mutual transfer of expertise, and 3) data sharing across partners (Jones & Wells, 2007). As such, the academic research team becomes part of the community, while the community members become part of the research team (Jones & Wells, 2007). Thus, researchers partnered with teachers by engaging them in the research process with the goal of creating useful and relevant resources to guide the implementation of technologies that support the academic writing skills of students in inclusive classrooms. The researchers and educators co-created a persuasive writing unit using technology and feedback provisions for the Grade 5 students. Ten teachers and their students (n = 246) from eight elementary schools (grades 4-6) within two school districts in urban and rural Alberta, Canada participated in the overarching study. The mean class size was 25 students.

Fig. 1: Research community of practice – Teachers and researchers co-developed the research project

Teachers were brought together prior to implementing a persuasive writing unit to explore appropriate tools and resources that support student academic writing within the curriculum and to provide input on the writing unit and activities developed by researchers (see Figure 1). Then, teachers taught the same persuasive writing unit with eight lessons. Students were instructed to complete their writing assignments on a device (e.g., iPad, laptop, Chromebook, desktop computer) available at their schools. Most teachers used Google Classroom to implement the persuasive writing unit with their students, a learning platform that uses Google Docs and other Google products, including Google Forms, Google Slides,

and YouTube. Each lesson contained several activities and graphic organizers. Teachers were instructed to complete as many activities as they could. Most students had one-to-one access to devices, including Chromebooks and iPads, while one class used computers in a school-wide computer lab. Students received feedback through the comment feature of Google Docs from three graduate research assistants (RAs) who acted as writing coaches, providing feedback to students on their writing assignments according to a *Writing Assessment Rubric* developed to describe the quality and grade level of students' writing. Teachers were able to view the feedback their students received. Using the revision history of Google Docs, teachers could view any revisions students made after receiving feedback.

Participants and Recruitment

At the end of the persuasive writing unit, teachers were asked if they were willing to be interviewed about their experiences using technology and feedback to implement the persuasive writing unit. Five (four females and one male) of the 10 teachers from the overarching study participated in semi-structured one-to-one phone interviews, which provided an opportunity to understand their unique perspectives and experiences. Interviews were conducted over the course of two weeks and each interview lasted approximately 30 minutes. Student participation in the study ranged from 87.5 percent to 100 percent across the five classrooms. On average, 97.6 percent of the students within the five classrooms participated in the study and received online feedback on their persuasive writing. A description of the study participants is shown in Table 1.

Table 1

Description of the study participants

Teacher	Class size	Grade	Gender
Michelle	20	5	Female
Melissa	22	5/6	Female
Mary	24	4/5	Female
Anna	24	5	Female
Daniel	27	5	Male

Note: Real names were replaced with pseudonyms.

Data Sources: Teacher Interviews

Data consisted of teacher interviews. Teachers were asked how they used technology in their classroom aside from the research project, how they felt about using technology to implement the persuasive writing unit, what worked and did not work about technology-mediated feedback, how students responded to the feedback, and whether they would consider using Google Classroom to give feedback to their students in the future. Interview questions were devised based on the core aspects of the persuasive writing intervention, with a focus on technology and feedback. The graduate students who had worked with each classroom over the course of a term were assigned to conduct interviews with the corresponding teachers with whom they had already developed a rapport. All teacher interviews were completed over the phone. When possible, the interviews were audio recorded to allow for accuracy of transcription. Interviews were transcribed from audio into text format prior to data analysis.

Data Analysis

A basic interpretive qualitative research approach was employed for this study. This approach seeks to "uncover and interpret" participants' understandings of their experiences through the identification and exploration of themes and patterns in the data (Merriam & Tisdell, 2015). Specifically, the collective case study method was employed to gauge themes across several cases and to gain a deeper understanding of teachers' experiences (Miles & Huberman, 1994). Teacher interviews were coded, and patterns and themes were extracted and agreed upon by the research team. The answers were coded according to two orthogonal dimensions: student/teacher and advantages/disadvantages perceived by teachers of using technology for persuasive writing.

Resulting Themes

Several themes emerged from the interviews: (1) integration of technology to support writing, (2) technology-mediated feedback, and (3) accessibility of technology, as shown in Table 2.

Table 2

Teachers' perceived advantages and disadvantages of using technology for persuasive writing from the perspective of both themselves and of their students

	Advantages	Disadvantages
T E A C H E R	Accessibility: ● Ubiquitous Technology: ● Students and teachers were familiar with Google Classroom to exchange information (e.g., assignments) ● Easier to collect students' work – paperless ● Teachers/RAs can see/access students' work, feedback, and revision history Feedback: ● Transfer: Encouraged teachers to provide more feedback on other assignments or classes ● Technology/feedback worked well ● Appreciation for the support of the RAs for giving feedback to students	Accessibility: ● One school provided access to a computer lab, not to 1:1 devices Technology: ● Difficult to track all the documents or when students handed things in/revised ● Would not allow assigning letter grades or percentile ranges ● Necessary documents were not always in the same format Feedback: ● Comments would disappear when students resolved them and it was an extra step for the teacher to retrieve them ● Overwhelming: there were a lot of different moving pieces to track
S T U D E N T	Accessibility: ● Ubiquitous: work on feedback anytime (school and home); cannot lose assignments Technology: ● Found it easy to cut, paste, or change sentences (as opposed to written work) ● Liked the overall process and were more engaged Feedback: ● Timely: can easily make revisions while working and they can look up ways of making the changes ● Specific: examples within feedback – helpful ● Directive: highlighted sections and comments enabled students to locate the suggestions and where to make changes ● More likely to make the suggested changes when RAs delivered feedback	Accessibility: ● One school provided access to a computer lab, not to 1:1 devices Technology: ● Had difficulty typing, could not use assistive technology (e.g., voice-to-text) ● Could not see feedback on iPads ● Did not know how to use revision history ● Had little prior Google Docs experience Feedback: ● Students poor self-regulatory processes interfered with effective feedback use ● Feedback was not always understood, so the teacher would have to clarify ● Students would read feedback too quickly and not understand it ● Not all students read the feedback ● Teachers had to direct students to attend to feedback

Integration of Technology to Support Writing

All teachers reported already using technology within their classrooms. Google Classroom was regularly used to distribute assignments, share information and resources, and to collect student work. Melissa reported: "We are a one-to-one device school, so the technology piece was very easy for us. There was not a learning curve in that." All the teachers reported that their students benefited from the various features afforded by Google Docs throughout the writing process. As opposed to writing in a paper-and-pencil format, Michelle revealed that her students could easily make revisions and changes based on feedback using cut-and-paste functions. Additionally, Michelle reported that her students benefited from the easy access to online resources to help support their opinion. Anna noted that her students with learning needs were easily able to use speech-to-text functions during their writing process.

Although all teachers identified many possibilities when it came to integrating technology to teach writing, practicalities and challenges were also noted. Teachers noted that the technology was not always easy to use. Students were working on various assignments and making changes, and the notification system to track students' work was not always smooth or efficient. Michelle noted that it was hard to track when students turned in assignments for revision and when they had made revisions. Due to all the moving parts, Melissa reported concern that she might have missed something, which could easily happen given that a notification was not always sent depending on the nature of the work or changes completed by the student.

Students also experienced some difficulty using some features of the technology. Two of the five teachers suggested that some of their students were unfamiliar with Google Docs features. Students needed to learn how to use the revision history, otherwise some of their work appeared lost. Students also had to learn how to use the comments tool. Some students would hit "resolve" to archive the comment and needed help retrieving it. In reference to her students' lack of knowledge and experience with Google Docs, Mary shared: "I just assumed that because I know how to do it, they know how to do it. They've never done this." Students required prior teaching to be able to utilize advanced features of Google Docs. Additionally, some teachers reported that their students did not take full advantage of the technology or had difficulty using their devices. Some students had difficulty typing. Other students did not use the assistive technology built into their devices to help with their writing. Daniel noted: "My students also know how to dictate but I don't think any of them used it for this assignment."

Despite some of the challenges students faced interacting with the technology, most teachers suggested that their students were highly engaged when using technology for writing. Melissa noted: "The kids loved being on the technology to write and complete and do everything." Similarly, Daniel noted: "Students were always engaged. [...] Some students can go ahead – this way I don't have the idle students. Go back, review, revise, and do edits."

Technology-Mediated Feedback

When it came to receiving feedback, teachers reported that viewing the feedback through Google Docs allowed students to see exactly what the suggestions were and where to address the suggestions within their text. The comments appeared right next to the target sentence, so students were not required to search for where to apply the relevant feedback. In addition, two of the teachers shared that integrating technology and feedback to teach writing created a collaborative environment for students. Daniel stated that using technology allowed his students to "[work] together but on different lessons," and Melissa mentioned that students would share feedback amongst each other.

All teachers emphasized the benefits of providing their students with timely feedback. Melissa stated that: "It is definitely something that will help them and guide them." Anna reported that her students loved receiving feedback. She recalled that her students liked that they were able to engage in a conversational manner with the writing coach, allowing them a personal connection to the feedback. Both Daniel and Anna reported being so encouraged by the process and nature of the informative and facilitative feedback that they took it upon themselves to engage in the process of giving feedback through Google Docs for other assignments. Consistency, specificity, and timeliness of feedback were identified by teachers as important factors for feedback. Melissa reported that the immediate feedback was beneficial to her students, while Mary identified that the constant feedback was useful for her students' steady progression in their writing, and Michelle identified that students benefited from feedback that was "straight to the point." Michelle also indicated that her students found examples provided within feedback helpful. Anna noted that having her students receive feedback electronically allowed for the feedback to be more personalized and private, enabling her students to engage more with the comments.

Three of the five teachers also noted that sometimes students' poor self-regulatory and self-determined processes interfered with their ability to make the best use of feedback. Teachers reported that their students often read the feedback too quickly to be able to fully understand and apply it to their writing. Michelle reported that, to help students understand the feedback given, she would have to prompt her students to reread the feedback and think about it in relation to their writing. Some students simply did not read the feedback. Mary noted: "A few of them looked at it. Others didn't quite get it." Students did not necessarily take the initiative to implement the needed changes. Mary noted: "You give them feedback and they don't implement the feedback further." Anna reported her students would read feedback, but their responses were typically, "oh I'll do that next time," rather than immediately applying the feedback to their current work. Daniel indicated that he would direct his students to both look at and implement the feedback as he found that some students would not do so on their own.

Accessibility of Technology

Teachers appreciated having all the students' work housed in one place on the Google Classroom platform. Students had access to necessary resources on Google Classroom as they worked on their writing assignments. Daniel shared: "When I handed the assignment to students on Google Classroom, I also gave them the PowerPoint [slides from the lesson]. I liked that they always had access to go back

and review [to] see what needed to be done." Both students and teachers had access to writing assignments and the feedback provided at any time, both at home and at school. "They were able to edit it and work on it wherever," shared Mary. Teachers could see each student's work individually, organized by name. In addition, students' past revisions were also available to teachers. Sharing all information, resources, and assignments on Google Classroom created a paperless learning environment. Daniel shared that this benefited him as a teacher: "I don't have to take anything home. I can review and look at [assignments] without papers getting lost." Both Anna and Michelle commented that their students were not losing pieces of paper or coming to class unprepared, as all the needed materials were found within their Google Classroom. Further, Anna indicated that she could monitor what students worked on within a day, what they had completed, and the progress made. She noted that the technology made it easier to collect students' work. She could see right on her computer screen who had and had not turned in their assignments.

Although, all teachers highlighted the benefits of housing the persuasive writing material and assignments online through Google Classroom, some teachers indicated that this format was sometimes impractical in classrooms where access to technological devices was limited. Only two of the five teachers interviewed taught in one-to-one device environments, where students had access to their individual devices. One teacher accessed technology through the school's computer lab, whereas all other teachers booked a cart of Chromebooks or tablet technology available within the school. Mary notes that, "not having the technology to do it as I was supposed to was really difficult" and that, "we only use technology in the computer lab." Not all features of Google Docs were universally accessible across all device types. Anna reported a preference for using Chromebook technology over tablet technology due to its compatibility with Google Classroom. When her students worked on tablet technology, she indicated that time was lost to troubleshooting technology-related challenges. Melissa's students all used iPads as their primary devices. On these devices, students were not able to see the feedback comments left by the writing coach. Students had to use alternative devices, such as Chromebooks, to view the feedback comments. In these cases, teachers needed to book the Chromebooks from the school. It is important to consider which technological features are universal to all devices and which are not when integrating technology in the classroom.

Discussion

This study aimed to explore elementary school teachers' perceptions of their interactions and of their students' interactions with technology for a persuasive writing intervention. Results of the teacher interviews provided a deeper understanding of teachers' perceived practices and experiences. Three themes emerged from teachers' responses: (1) integration of technology to support writing, (2) technology-mediated feedback, and (3) accessibility of technology. First, integration of technology to support writing was embraced by the majority of teachers and students, which is largely in concordance with existing literature. Second, technology-mediated feedback provided value for both teachers and students. Third, accessibility of technology was generally helpful, but teachers also reported some

challenges associated with it, including sporadic technology malfunction, variability in familiarity with technology (both theirs and their students'), as well as students' abilities to understand and process the feedback.

Theme 1: Integration of Technology to Support Writing

Although they used technology in slightly varied ways, depending on the hardware they had at their disposal or their school culture, teachers used Google Classroom regularly to distribute assignments, share information and resources, and collect student work. All teachers reported that their students benefited from the various features of Google Docs throughout the writing process. Their reasons included the ability to easily make revisions and changes using cut-and-paste functions and easy access to online resources to support writing. In addition to technology as a practical tool, teachers also saw technology as a motivator for students who would otherwise be less enthusiastic about writing. Teachers reported that their students enjoyed using technology to improve their writing, partly because it was easier for them to change their writing and partly because they enjoyed the process of receiving individualized feedback. This result is consistent with prior literature highlighting students' positive attitudes towards the use of Google Docs for writing, editing, and feedback (Suwantarathip & Wichadee, 2014; Zheng et al., 2015).

Teachers also noted practicalities and challenges when it came to integrating technology to support writing. Teachers noted that technology was not always easy to use and it sometimes malfunctioned. Some students were unfamiliar with Google Docs and required teaching to utilize more advanced features. When using technology to support learning, students may not be able to take full advantage of the technological features unless explicitly taught.

Theme 2: Technology-Mediated Feedback

Overall, teachers reported that feedback was beneficial to their students. Two of the teachers indicated that they were able to apply lessons learned from weaving technology into the persuasive writing process to other classes and even other content domains. Despite teachers recognizing the benefits of timely and individualized feedback for students, it is often difficult in a regular classroom to provide students with the feedback they need and to improve their conceptual understanding of the elements of persuasive writing. Consistency, specificity, and timeliness of feedback were identified by teachers as important factors for feedback. These factors are also present within literature examining the principles of effective feedback (Hattie & Timperley, 2007; Schwartz et al., 2016). Some teachers observed that sometimes students' poor self-regulatory and self-determined processes interfered with their ability to apply the feedback. Students needed to be prompted to apply the feedback immediately. Even when consistent feedback is provided, students require encouragement to engage in a deliberate practice of revision (Ericsson et al., 1993). Winstone, Nash, Parker, and Rowntree (2016) describe "proactive recipience" as a state of active engagement in the feedback process. Thus, teachers confirmed that, for feedback to be effective, learners needed to share responsibility.

Theme 3: Accessibility of Technology

Many practical benefits of the Google Classroom platforms were noted. Teachers reported that using Google Classroom enabled both students and teachers to access necessary resources from any location at any time, decreasing the incidence of lost materials and assignments. Of course, some malfunctions were noted. Access to Google Classroom was not universal across devices. For example, students in one classroom could not view feedback comments using their tablet device. Additionally, physical access to technology was limited, as not all students had access to one-to-one devices. While teachers in our study were able to overcome the technological obstacles of embedding technology into their writing instruction, a lack of technology support and access can discourage teachers from using educational technology in their practices (Buabeng-Andoh, 2012).

Limitations

A major limitation of this study is that teachers self-selected to participate in the study. Only the teachers who agreed to being interviewed participated. Therefore, it is unclear whether the views of the five teachers interviewed are representative of the experience of the larger group of teachers who participated in the overarching study.

Recommendations

The following recommendations on how to integrate technology into teaching persuasive writing to best support teachers and students emerged from the study findings:

- discuss technology options and develop a plan of action in collaboration with the teachers, as they know best the capabilities of their students and of their school's technologies

- design a training step for both teachers and students with regards to the technology used, so that teachers can become aware of possible bottlenecks for students and guide the students

- ensure that students can access and can understand the feedback provided

- recognize that students may require different ways of delivering the same feedback content and that the feedback must be divided into smaller units that can be acted on in isolation

Conclusions and Implications for Practice

The study contributes to an understanding of resources and methods that will foster high-quality learning environments for students. Thus, it contributes to the literature on integrating technology into teaching and learning of persuasive writing in elementary classrooms. Results indicate that both teachers and students found the intervention that blended technology, feedback, and persuasive writing pedagogy to be useful and enjoyable. The study aimed to explore five elementary teachers' perceptions of their practice in teaching persuasive writing, as well as their perceptions of their students' engagement with

persuasive writing when technology was integrated into the teaching and learning process. Specifically, technology was employed to provide feedback on students' persuasive writing as a way to support teachers in facilitating students with timely, personalized feedback. As such, teachers found technology-mediated feedback to be a valuable tool that can be incorporated in persuasive writing, as well as in other domains. As they are assisted in exploring new ways of harnessing technology to teach persuasive writing, as well as in developing and implementing writing activities that support and augment these skills, teachers can help students become better writers. Using the affordances of technology, teachers can also reflect on their own persuasive writing teaching practices, as well as on their perceived students' experiences with persuasive writing. Recommendations for implementing similar types of interventions should take into account the volatile nature of using technology in real time (e.g., access, hardware malfunction, Internet issues, etc.) for disseminating information among teachers, students, and researchers, as well as the variability in types of technology, in levels of familiarity with technology, and in student abilities and experiences.

This study also empowered students to augment their learning of persuasive writing skills by acquiring process knowledge, not only persuasive writing domain knowledge. Specifically, students engaged in deliberate practice by writing and rewriting on their favourite topics. Students were also more invested in their work, as they received personalized feedback based on their skill levels and could request continuous guidance from the teacher and the RAs, both face-to-face in school and also virtually after school via the online Google Classroom platform. Thus, technology has the potential to expand the classroom time and offer both teachers and students a meaningful experience and a fruitful learning experience, offering a platform for teachers to connect even more with their students and be more aware of their students' strengths and weaknesses. Finally, this experience was equally beneficial to the research team who explored and analyzed effective pedagogies that the teachers had already applied successfully in their classrooms, combining these pedagogies with evidence-based approaches to codevelop materials that were relevant to both children and their teachers.

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Maria Cutumisu, Chantal Labonté, Vanessa Oslie, Elizabeth Gange, Heather M. Brown, and Veronica R. Smith

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Does Your School Have the Maker Fever? An Experiential Learning Approach to Developing Maker Competencies

Ann-Louise Davidson and David William Price

Abstract

The maker movement in education is linked to better, more authentic learning that can help students develop 21st century competencies. Maker experiences, like any experiential learning, can be limited by decontextualized, recipe-style labs and fail to deliver on the promise of engaged learners ready to learn on demand and solve the ill-defined problems of the 21st century. Our multiphase research program on maker culture in education held a series of exploratory workshops and social events to discover the competencies required to turn experiential learning with technology into maker experiences that meet 21st century needs.

Experiential learning is a valued approach in education, but can be limited by recipe-style labs, decontextualized skill development, or reliance on kit building. Maker culture is a form of experiential learning with technology that promises engagement of learners via iterative, ill-defined problem solving and self-directed learning to satisfy 21st century needs. However, when appropriated for educational experiences (rather than used as a means to solve personal or community challenges) maker culture faces similar risks as all learning: that technology will amplify existing practices, rather than transform them (Davidson, 2007; Price, 2014). Technology and experiential learning are not the sole components of a *maker experience.* This article reports on the first year of a multiphase research program on maker culture in education. We held a series of exploratory workshops with children, women, and men from all strands of life, with a wide range of educational backgrounds and technology experience. We conducted a mini-maker faire, built arcade game tables and a 3D printer, held weekly *maker jams* in our lab, and set a design challenge to develop a gamepad for people living with Parkinson's disease. In light of maker culture literature, we analyzed participant experiences to discover what they suggest about the competencies required to turn experiential learning into maker experiences that meet 21st century needs. We also looked for what characteristics of experiential learning activities appear to assist or undermine those maker competencies.

Context

Over the past 10 years, a body of literature has started to suggest that maker culture can address 21st century skills. Maker culture embodies do-it-yourself tinkering using tiny, affordable open-source computers, electronics, and recycled items to further sustainability, equity, social innovation, democratization of innovation, and community building (Andersson, 2015). Makers engage in self-directed experiential learning through risk-tolerant, persistent problem solving in interdependent

communities tackling complex, socially relevant problems. In contrast to the long-term vertical career paths of the past, 21st century individuals face ongoing instability, heavier workloads, diverse global teams, short-term contracts, and frequent changes in expected skills (Patton & McMahon, 2014). Continual, self-directed learning and habits in "curiosity, persistence, flexibility, optimism, and risk-taking" are needed to turn "happenstance" into valuable opportunities (Mitchell, Levin, & Krumboltz, 1999 in Patton & McMahon, 2014, p. 392) and build diverse stepping-stone experiences that lead to unimagined results (Stanley & Lehman, 2015).

We know that integrating technology in teaching is challenging (Selwyn, 2015; Watson, 2006) and does not guarantee a change of pedagogy (Bennett & Lockyer, 2008; Davidson & Desjardins, 2011; Price, 2014; Underwood et al., 2010). The current shift from technology literacy to computer coding in schools (Dredge, 2014; Kemp, 2014) to develop problem-solving skills (Kemp, 2014) risks failure because procedural approaches often used in schools are not personally meaningful to the students (Somanath, Morrison, Hughes, Sharlin, & Sousa, 2016). A linear, objectives-driven approach hampers innovation through contrived exercises, recipes, and rewards constrained by today's imagination (Stanley & Lehman, 2015), such as one-size-fits-all skilling-up using lab tasks, programs in which everyone learns coding for the sake of coding, or assembling kit electronics that can only execute a finite number of operations. Using technology products with too few affordances or limited coding opportunities provides short-lived learning experiences that learners struggle to apply to other problems for themselves or others.

With the demand for STEAM (Science, Technology, Engineering, Arts, and Mathematics) activities and 21st century competencies, we need to encourage learners to develop skills for collaboration, creativity, problem solving, creative computational thinking, and critical thinking. The rise of makerspaces in schools, libraries, and community centers and the popularity of experiential learning give us an opportunity to refocus on iterative design and engineering to solve meaningful problems (Hira, Joslyn, & Hynes, 2014).

Literature Review

Between Teaching by Transmission and Learning by Experience

Teaching by transmission, such as lectures, is a passive experience that gives students a false sense of security about learning and fails to elicit misconceptions (Berrett, 2012; Mazur, 2013). Modern graduates must access information as needed, and adapt to change (Barnett, 2009; Felder, Brent, & Prince, 2011). Rather than plod through defined problems, graduates must confront unfamiliar and ambiguous situations from multiple perspectives, and develop imperfect answers while considering potential consequences (Tsui, 2012). Technology-based skills become decontextualized and outdated in schools (Blikstein, 2013). Although technology has immense potential to support learning (Kozma, 1994), it can be undermined by dated teaching approaches (Price, 2014; Clark, 1983). School labs may focus

on rediscovering known principles using defined equipment in limited time periods, while engineering approaches require problem-solving studios with iterative, rapid prototyping in diverse teams that embrace failure while developing complex, original solutions (Blikstein, 2013).

Making is a booming trend for developing 21st century technology skills. Digital *makers* participate in digital do-it-yourself (Andersson, 2015; Fox, 2014) using tiny, open-source Raspberry Pi and Arduino computers with sensors, motors, and networking, as well as 3D printers, laser cutters, woodworking, and crafts. People use *making* to solve problems, defy consumerism, and shape their world (Charny, 2012). Making is promoted as way to develop 21st century skills, but it risks being appropriated by institutions, stripped of risk and empowerment, and delivered in safe, correct recipes that meet demands for control and predictability.

A growing body of literature reports on learning through making (Cohen, Jones, Smith, & Calandra, 2016). In education, the maker movement brings new opportunities because of innovative tools and technologies, including 3D printing, robotics, microprocessors, wearable computing, and a variety of programming languages (Weareteachers Staff, 2013) that are accessible to a wide public through open-source platforms and makerspaces. The next section details the various types of makerspaces and their affordances.

Makerspaces

Makerspaces come in all shapes and forms. While some makerspaces are permanent and dedicated spaces, some are pop-up spaces that can be set up for special events and some are mobile and can serve several communities (Kafai & Peppler, 2014). Makerspaces support multidisciplinary, individual, and collaborative learning through iterative error- and risk-tolerant tinkering, offering multiple points of entry including repairing items, building robots, and creating (Sheridan et al., 2014). The concept of visibility is very important in these environments, which includes "open cabinetry, see-through bins and visible access to the tools, materials, and existing objects that spark ideas for new makes" (Peppler, Halverson, & Kafai, 2016, p. 5).

Makerspaces draw young learners off their couches to help people feel useful by solving problems, sharing their growing expertise, and learning to "stick with things more when they're not working" (Sheridan et al., 2014, pp. 518–519). They focus on tinkering through ideation, iteration, creation, and collaboration (Peppler, Halverson, & Kafai, 2016). Makerspaces exist in several formal environments, such as schools (Burker, 2015), and informal environments, such as museums (Sheridan et al., 2014), libraries (Harris & Cooper, 2015; Haug, 2014,) and community centers (Sheridan & Konopasky, 2016).

In creating makerspaces, educational institutions strive to allow participants to develop technology skills and conceptual knowledge (Blikstein & Krannich, 2013) in electronics, material properties, 3D modeling, and about how we interact with objects and how objects interact with each other. Some maker activities in school makerspaces include 3D modeling and printing, woodworking, designing electronic toys, and using dismantled broken technology for new purposes. Although increasing in numbers, Wohlwend,

Keune, and Peppler (2016) point out that these types of activities in schools are still rare. In a case study, they designed elementary school makerspaces with four orientations of making: play, design, technology, and collaboration. They noticed that some students tended to work solely around circuits and when they were done, they didn't seek to collaborate or play. Others went straight to collaboration to ask how others made what they were doing. While some were ready to work in teams, others just wanted to take what they needed and leave. Their study begs school makerspace organizers to embed tinkering and collaborating into the design of their spaces to provide meaningful activities for students. This is supported by Wardrip and Brahms (2016) who suggest that principals and teachers need to analyze their school space and determine how making may fit the school infrastructure, whether it be integrated to several classes or it be a dedicated makerspace. With the diversity of maker activities, what is most important is that whoever is assuming the leadership keeps in mind that successful implementation is to engage students in STEAM learning developing 21st century skills important for workforce development (Benton, Mullins, Shelley, & Dempsey, 2013).

Museum-based makerspaces offer environments for family participation. Some researchers explored how museum makerspaces can involve young children in making activities as meaningful participants (Brahms & Crowley, 2016). Their research has shown that children are able to conjugate personal, social, and material resources and as they develop better relationships with resourceful adults, they develop refined knowledge and skills that they turn into refined practices (Brahms & Crowley, 2016).

Library makerspaces focus on offering patrons new opportunities to try out new technologies, to play with tools and interfaces (such as 3D printers, virtual reality, or visualization technologies) that are not available in all homes, to create sound, to get initiated to computer programming, or to engage in traditional crafts (Britton, 2012). A recent study (Moorefield-Lang, 2015) found that the core issues are relate to the locus of control regarding the decision to create a makerspace in the library (as it is usually not the librarian's idea), the staffing of the makerspace, and the training of librarians to work in a makerspace. However, makerspaces in libraries are worth pursuing because library makerspaces are safe spaces to try new things and fail without many consequences. Libraries bring new ways to become engaged in learning, which as Curry (2017) points out, can upset the current capitalist model, but they have the potential to give resources to a wider population and bring hope to people that never thought they could develop technology or creativity skills, and the freedom to obtain the education they want.

Community makerspaces are designed around the ethos of resourcefulness (Sheridan & Konopasky, 2016). According to these authors, community makerspaces grow organically and are built from needs and wants from the community members who want to develop enhanced skills, including creativity, complex problem solving, persistence, collaboration, and courage, and share them with others. In fact, these spaces have life because of the engagement of community members who thrive on sharing what they learn with others, on asking what they can do with what they have, and on feeling satisfied from making things without spending money they don't have. This ethos of resourcefulness can be designed through the space, through being open and transparent, creating opportunities, and encouraging bootstrapping.

Upon visiting makerspaces and observing maker activities in educational locales, we noticed that maker activities can be appropriated for disciplinary curriculum content without exploiting their potential to prepare learners for 21st century demands. That is, maker activities can result in unintended consequences. For example, maker activities can produce *technofetishists* who consume kit electronics and engage in technical competitions, rather than social innovation (Hertz, 2012). Maker culture can become a *lifestyle choice* (Dieter & Lovink, 2012) of privileged people who tinker with blinking lights and mediocre DIY (Csikszentmihalyi, 2012). Makerspaces can become services for hire, rather than collaborative communities, and maker classrooms can become incubators for electronics consumers and technical workers to serve industrial and military needs (Hertz, 2012). Blikstein (2013) notes risks from digital making in education depending on underlying values: (1) *keychain syndrome*, whereby participants focus on production of simplistic, but attractive maker products, such as 3D-printed keychains, rather than engaging in risky processes of failure and adaptation; (2) lack of time for failure or multiple iterations and lack of space to continue work outside of class and develop working relationships with peers; and (3) structuring *making* around short school periods, and limited resources such as one 3D printer operated by a single expert, instead of allowing hands-on iterative prototyping. In contrast, Blikstein (2013) notes the potential rewards of fostering an ongoing, process-focused maker activity in a dedicated space: students exploring recreational and artistic interests in unusual ways and persisting through failure and developing diverse teams all while happening to learn STEAM-specific skills.

Given that experiential learning with technology can engage people disadvantaged by traditional education, but risks being turned into predictable kit-building and keychain production that fit into tidy schedules and supports existing curricular demands, it is clear that technology is not the key component of a maker experience. Therefore, in this study we focused on the competencies that can be developed in educational makerspaces and in other contexts that require 21st century competencies.

Methodology

Research Approach

We recruited over 100 participants in schools, colleges, universities, and community centers for a series of maker events and workshops. Our participants were children, women, and men from all strands of life, with a wide range of education and technology experience. As we adopted a participatory research approach (Heron & Reason, 1997), "participant" also includes "maker advocates" (participants who engage in helping novices become makers).

This article considers a selection of data from the following events:

1. a mini-maker faire with a fabrication showcase of a 3D-printed shoe and an iPad-controlled espresso machine by experienced makers, and interactive tables where participants with no maker experience could experiment with technologies such as light emitting diodes (LED), electric motors, coding, and soldering;

2. a collaborative build of a Prusa i3 3D printer kit with a team of graduate students and fab lab enthusiasts;
3. weekly *maker jams* in our lab, open to the university and the broader community;
4. a design and build of game controllers for people with specific disabilities; and
5. arcade table builds using Raspberry Pi single board computers, inexpensive IKEA tables, and reclaimed computer parts—one with children at a community centre, and another with university students.

Our data collection spanned from June 2016 to May 2017. Given 21st century needs for people who can address ill-defined and unfamiliar problems in unexpected contexts by learning and adapting as needed while engaging in iterative and collaborative prototyping using modern technology, we asked the following research questions:

1. What do participant experiences with experiential learning with technology suggest about the competencies they need to meet such 21st century needs?
2. What are the characteristics of those experiential learning activities that appear to assist with or undermine those competencies?

Data Collection and Analysis

As part of our research program on maker culture in education, we are documenting competencies that emerge from maker culture activities and events. We developed data collection instruments to monitor participants within their maker experiences, namely an observation grid (to capture data such as the location of the activity, the environment, the purpose, the materials used, and the interactions among participants, and between participants and maker advocates), some qualitative research instruments including field notes, post-mortem reflections, observation checklists, and informal and semi-structured interviews. We also use participatory action-research tools and techniques, such as those developed by Chevalier and Buckles (2009), to better structure dialogue with participants as maker activities began, progressed, and ended. We extensively document events with photos and videos to allow observations afterward.

After each event, we hold a research team meeting to discuss the observation grids, our field notes, and postmortem reflections to discuss events that surprised us, activities or attitudes we need to pay attention to, and discuss potential emerging themes, namely those that suggest specific competencies to focus on. The informal and semi-structured interviews are transcribed and analyzed using HyperResarch, a qualitative data analysis software.

The data we discuss in this article were analyzed using statements and connecting them to concepts and themes, using a grounded theory approach (Strauss & Corbin, 1990). This allowed us to reflect on competencies that have been discussed as desirable in the maker-related literature (e.g., learning to ask questions, persist when encountering failures, build trust and relationships) and beyond. With multiple rounds of reflections on the emerging competencies, we identified several categories. We then triangulated these categories with elements we had identified in our field notes and in our multimedia documentation. This allowed us to identify themes for the categories of competencies that were needed

to succeed in maker activity, and what characteristics of experiential learning helped or hindered those competencies. Our thematic analysis was conducted by two researchers with multiple rounds of feedback to revise and fine-tune emerging themes.

Findings

This section presents themes emerging from our participants' experiential learning with maker activities to address 21st century needs. Five themes emerged regarding success in maker activities: initiative, playful learning, authentic adaptation, interdependence, and over-resourcing.

Initiative. Participants who truly wished to engage in maker activities sought to get their hands dirty. They showed up to multiple events and were willing to take on challenges, to try new things, and to learn new tools as needed. In contrast, during planning meetings, some potential collaborators showed no interest in prototypes from another participant, but wished only to contribute their existing academic expertise.

We saw a direct relationship between developing maker competencies and the willingness to learn new tools. A minority of participants felt comfortable using power tools and when it came to showing another person how to use them, they did not feel competent enough to use them safely and did not want to touch them. One participant said, "No I refuse to use the power tools. I am too afraid to injure myself and I don't feel confident that I can use them with precision." After a competent teacher taught her the basic elements of safety and let her manipulate the tool with wood scraps, the participant spent a considerable amount of time building an arcade game using the power tools to fit components into an IKEA Lack table. One participant said, "I am confident I can use a drill and a saw. I have seen people use them, I have used one myself before and I know I can do it." When the time came to use the tool, she said, "I need someone to watch over me because I have not done it often enough."

Any maker activity requires the use of tools, whether physical or mental, but it is not always clear which tools will be needed in advance, whether for complex builds, such as a 3D printer or an arcade table, or more simple builds such as a remote-controlled car or a Bluetooth sound system. For example, upon dismantling old speakers during the arcade table build, one participant broke a wire and was ready to throw them out. Although the broader project did not require soldering, we introduced the skill to resolve the immediate problem. The participant said,

> Once I removed the speaker from their cases, the wire broke. I changed the wire for a better quality one and soldered it. I also put a blob of hot glue in case the wire moved too much. I didn't realize we could glue wires.

Our first lesson was that learning with maker-led activities requires us to get our hands dirty.

Playful learning. Many makers who showed up to our workshops or challenges were novices to maker culture driven by curiosity instead of expertise. Expertise can be a barrier: during planning sessions for the research project, potential collaborators did not engage with our sample prototypes, and preferred to offer their existing academic expertise. During workshops, maker advocates faced a challenge of holding

back: participants complained that the 3D printer build was overly controlled because, as their self-efficacy rose over the first day, they were feeling too constrained by a structure that limited their freedom to make mistakes. During the community arcade table build, the children were at times disengaged when adults took over planning and measuring to ensure it was correct.

We held maker jams on sustainability and reusability themes where participants dismantled old technologies for reuse in other projects. For example, when dismantling a DVD drive, one participant said:

> I read that I could use the servo from the DVD drive in my car, so I started dismantling one. I had no idea how to remove the servo. I removed one part after the other and at one point there was one piece I could not remove. I looked with a magnifier to see if I was not missing something but there were no screws. Then someone told me to pry it open. I used a screwdriver as a lever until the part gave. I realized I had a super magnet in my hand.

Disassembling technology to discover its reusable components was a powerful learning experience that no kit can teach because there are no recipes or rules to follow.

While building an arcade table with children, we decided to build a prototype and test the parts and the design as we progressed. Every time they completed key steps of the build and tested the console, they high fived and did a short celebratory dance. Upon finishing the arcade table, one child said, "My favourite part of the whole project was that we learned to solder," a skill they had learned when fixing a broken part. When asked what he would do differently next time, the participant said, "I would build another table for two players instead of one." Building an arcade table is a challenging 20-hour project, but the children were enthusiastic about their new skills and wished to build a more complex version. The use of mock-ups, repairs, and design iterations suggests that they were embracing playful iterations to improve the project.

Our second lesson was that learning with maker-led activities requires us to embrace playful iteration.

Authentic adaptation. Makerspaces are specifically designed to provide the tools and collaborative space that support maker activities, but not all maker activities happen in makerspaces. Some of the challenges and workshops we held were in spaces that were not specifically designed for maker activities, which reflects the expectation that participants need to be able to practice maker competencies outside of a lab, and educators may not have access to lab space.

The multi-week arcade table workshop we held at a community centre started upstairs in a quiet office, but was moved down into the rambunctious common room, where youth shouted while playing table tennis and foosball, in order to better integrate with the broader community that was too timid to participate. While participants assembled the joystick and buttons, table tennis balls were flying and children were running around us to get their balls. One research assistant received a ball on the head while trying show a participant how to code. This was challenging because the activity required focus, but for the children, it did not matter. One child came a few times to kneel and beg one of our participants to play table tennis. Our participant said, "Not now. You don't understand. I need to do this.

I'll play another time," even though at other times he had confessed he had a hard time focusing on school activities. In a later week, the same child came to work on the project despite injuries from what appeared to be a schoolyard fight.

Adaptation to changing participants was required in many workshops. In the 3D printer build, the maker advocates agreed to a small group, but two additional people joined on the first day for a group of 10. On the second day, a participant brought her two young daughters (who often sought her attention), and yet another participant joined. After lunch, four participants left for other commitments. These changes disrupted group dynamics and resulted in new participants requiring assistance with catching up on the build to complete it. Similarly, weekly maker jams, scheduled between 5:00 and 7:00 p.m., attracted different levels of participants who were often so focused that they stayed late.

With changing locales, participation, and open-ended schedules, managing parts and tools can get chaotic. One participant started keeping a list for makers to note when they checked out a tool. Another participant numbered and labelled tools and parts with blue and green masking tape to track use in the field. At the end of the year some makers started taking responsibility for managing tools and suggested that some tools and parts be kept locked at all times to reduce loss and limit confusion.

Our third lesson was that learning with maker-led activities requires us to manage activities in imperfect environments.

Interdependence. Participants who engaged in maker activities valued learning through interdependent interactions. Interdependence can be challenging because its success requires sharing control of an experience, and sharing expertise, rather than taking over to demonstrate competence. For maker advocates, the desire to achieve a working 3D printer by the second day, or a finished and working arcade table when energy was running low, could lead to taking control.

In contrast, while building the 3D printer, whoever didn't know how to strip wires was the person nudged into doing the wire stripping. In any other circumstance, the skilled person would have picked up the wire strippers and stripped the wires. However, to ensure that everyone could strip wires, skilled participants encouraged novices to learn by doing. One participant said, "I know how it's done, but I prefer not to do it." Another participant said, "Why don't you want to do it?" The first participant said, "Because I'm afraid I won't do it well, or I might break something." The other participant explained that we had plenty of wire so we could make as many mistakes as needed. This had a double impact where less-skilled and intimidated participants learned hands-on, and those who already had the skill were able to shift their expertise into coaching.

Also during the 3D printer build, a poorly manufactured part for the 3D printer did not fit. Some participants were convinced that one of the rods was too big. Other participants helped with the troubleshooting and decided to remove an identical part to see if it fit and it did not. One participant decided to use a caliper to measure the slot and suggested that a small amount of metal should be removed. Enlarging the slot too much could cause a major problem, so participants agreed to use the most skilled person in the team to grind away a fine layer of metal. However, after his departure,

there was a grinding noise during operation suggesting a second problem, which was resolved by bending the bracket more open by hand. Participants negotiated a balance between moments where novices could learn skills by engaging hands-on, and moments where major mistakes should be avoided by deferring to more skilled assistance. However, had all participants remained engaged until the troubleshooting process was complete, everyone would have more fully understood the multiple problem-solving issues at stake.

For maker activities to be successful, participants needed to be able to take turns in trying a new skill. For example, during an arcade table build with children, two participants were dismantling speakers from their plastic housing. An older participant kept grabbing the tools from the younger participant, and when asked if he wanted to try, the younger participant said, "I don't care, let him do it." We were not sure how to interpret his reaction, but we made sure that he was able to engage in later dismantling when the occasion arose and he was happy to do it. In the final interview, he said his favourite part of maker activity was learning how to dismantle things and use new tools. We wondered how we might help impatient participants shift their inclination to take control into a new skill of coaching.

Our fourth lesson was that learning with maker-led activities requires us to embrace interdependence.

Over resourcing. When participants engage in maker-led activities that are not commercial kits, extra time and resources need to be factored in or maker advocates may take too much control and focus on efficiency, accuracy, and completion of the originally envisioned final product in order to meet artificial constraints.

When participants tried to hack into retro gamepads for an accessibility challenge, nothing they planned initially worked. Many attempts were required to understand how to dismantle the game pads, how the circuit worked, and what amount of pressure was necessary to create a working circuit using the extended controls. One participant, recognizing the importance of investing time in some learning, invited an electrical engineer friend to assist, and said, "I need to figure out the basics. Once we have that, we can build the extended controls later, but there are a few things we need to understand first."

On several occasions, participants worked on fabrications that were unattractive, but represented stepping-stones in self-efficacy. One participant, who built an Internet-enabled weighing scale using a microcontroller, load cell, and ABS pipe, showed his fabrication to the planning team. One collaborator, who was a programmer, looked at the exposed wires and said it looked like a rat's nest. This is exactly why he wanted to use developer kits. The wiring is figured out and he can focus solely on the code. The participant who had fabricated the prototype noted that it merely represented a working proof of concept. The conversation highlighted a difference between learning through purposeful and iterative fabrications versus learning to code with ready-made products.

During the maker faire, participants sat around exploration stations and engaged with sewing blinking LEDs into fabric flowers, building robots out of motors and markers, programming in the Scratch language, and controlling commercially available programmable robots. Some of the projects that were meant to introduce kids to robotics captivated university students. One participant said,

"I was so proud of my robot!" Two other participants stayed around this table for several hours to do a robot combat. They wanted to know which robot would win over the other. The programming station generally intimidated participants. The wearable electronics station, which was meant as a demonstration of creating a circuit with a light emitting diode (LED) using conductive thread, became a circle of seamstresses where participants sat for several hours. Participants in general said that it was relaxing to sew the wearable electronics, but the programming activity was intimidating. However, having sewed the blinking LEDs into fabric flowers, some were motivated to learn more about programming, which they thought was more complex. This suggests that providing a variety of consumable materials and more time for playful learning can encourage participants with no maker experience to enjoy maker activities and seek further experiences.

During an arcade table build, after holes for the controls had already been cut in the table surface, some participants argued about the layout of the controls and whose hand the buttons would serve. The build was dismantled and its parts were reused in another build, with the loss of a table deemed unimportant despite some participants' concerns about waste. One participant said, "We can use it as an example for future workshops."

Our fifth lesson was that learning with maker-led activities that requires us to make progress happens over bumpy roads, not on super highways.

Discussion and Lessons Learned

To address criticisms of traditional education, we examined experiential events where volunteer participants actively applied technology (such as microcontrollers and reclaimed parts of computing products) to build a solution with others without prior training. In this section, we address our research questions: given 21st century needs for people who can address ill-defined and unfamiliar problems in unexpected contexts by learning and adapting as needed while engaging in iterative and collaborative prototyping using modern technology:

1. What do participant experiences with experiential learning with technology suggest about the competencies they need to meet such 21st century needs?
2. What are the characteristics of those experiential learning activities that appear to assist with or undermine those competencies?

What do participant experiences with experiential learning with technology suggest about the competencies they need to meet such 21st century needs? Our study supports findings in the literature that participants can learn from and be engaged with hands-on making (Cohen et al., 2016) of diverse non-curricular projects (Stager, 2013). We engaged a wide variety of participants ranging from children to middle-age, from middle school to post-graduate education, with a variety of projects including building an arcade table, and building a 3D printer. Regardless of age or education, learning included jumping into activities without prior training, learning new tools as needed, adapting to imperfect locales and changes in participants, engaging in interdependent collaboration, and making time for learning from mistakes.

Our study supports findings in the literature that participants facing learning challenges can learn through *doing* without strict recipes (Somanath et al., 2016) and engage with and persist with maker activity (Sheridan et al., 2014). Most of our maker experiences occurred over several days, and the arcade build with the children occurred each Friday afternoon over a number of weeks. Despite educational challenges, entreaties from peers, and schoolyard tensions, the children persisted with the project until the end and took great pride in their accomplishment. Despite challenges in our 3D printer build, such as poorly manufactured parts and changes in participants, our participants were modelling and printing a sample object by the end of the second day.

Our analysis suggested key themes of initiative, playful learning, authentic adaptation, interdependence, and over resourcing. These themes can be developed into "maker competencies" to meet 21st century needs:

- Participants show "initiative" when they embrace novel challenges, and new hands-on tools as needed to meet those challenges, by building on what is familiar without hiding in what is comfortable.

- Participants show "playful learning" when they demonstrate playful curiosity and iterations of design, repair, and rework in order to optimize long-term learning while achieving short-term goals.

- Participants show "authentic adaptation" when they adapt to authentic environments with changing participants and gaps in resource management.

- Participants show "interdependence" when they actively balance collaboration to redirect competition and control into mutual vulnerability, mentorship, and humour to optimize learning through risk-taking.

- Participants show "over resourcing" when they provide extra time and resources to allow for mistakes, exploration, and revisions in goals as part of a learning process while pursuing a solution.

What are the characteristics of those experiential learning activities that appear to assist with or undermine those competencies? If our "maker competencies" are the desired outcome of experiential learning, we must ask whether our maker advocates (the people participating within an event to help novices become makers) are approaching experiential learning from a "maker competency" perspective:

1. Are they creating situations (and adjusting them) such that participants are nudged into demonstrating and fostering initiative, playful learning, authentic adaptation, interdependence, and over resourcing?
2. Are they demonstrating the desired competencies through their own participation?

As noted previously, the literature suggests that experiential learning with technology can engage people disadvantaged by traditional education, but risks being turned into predictable kit-building and "keychain" production (Blikstein, 2013). Technology alone is not the key component of maker competencies. Any activity can be turned into a risk-averse recipe to be followed in a lab by dependent learners and assessed for meeting a predetermined goal within constrained time and resources (Blikstein, 2013).

Although ill-defined and ambiguous problem-solving is the goal of maker activity (Tsui, 2012), some of the events in this study were defined in the sense of achieving an arcade table previously documented on the Internet, building a 3D printer from a kit, and constructing a game controller for people living with particular health conditions such as Parkinson's disease. Coding was limited to configuration of existing software. While we cannot claim that our workshops and events were all ill-defined and highly technological, we gained insight on variations of maker activity design. We noticed that not all novice makers needed structured designs, but without some structured experiences to start with, some participants might never engage in maker activities. For example, blinking a light with an LED is a good introduction to circuits that needs to be integrated into a more purposeful activity or social innovation.

This article refers to maker advocates as participants because we adopted a participatory paradigm for our research program. Heron and Reason (1997) suggest that the participatory worldview, "allows us to join with fellow humans in collaborative forms of inquiry" (p. 275) and "the choice and assertion of a participatory worldview is fundamentally experiential" (p. 276). The participatory approach is a good fit with maker activities, but it requires devolving responsibility across participants. It can be tempting for "educators" to view themselves as responsible for creating experiences for others, to remain as experts who plan, guide, control, evaluate, and troubleshoot a project to ensure continued progress, to look competent, and to achieve the desired end product. Davidson and Desjardins (2011) describe this as typical of teacher-centered, product-oriented pedagogy. In contrast, a more learner-centered, process-oriented pedagogy is needed where maker advocates shift their role into nudging participants into developing the maker competencies we identified: initiative, playful learning, authentic adaptation, interdependence, and over resourcing.

For the 3D printer build, maker advocates over-planned and organized the first day such that participants noted the lack of challenge as their confidence grew over the course of the first day. For the maker advocates, the goal of a working printer by the end of the second day was more important than allowing participants to make mistakes. For the arcade table build with children, maker advocates loosely followed a process borrowed from the Internet, and at times took over planning, measuring, and marking activities while leaving the tool use to the children, particularly as the weeks passed and energy waned.

Future endeavours in "maker" learning would focus maker advocates on how to ensure participants' initiative blossoms in a vacuum of expert answers and predefined challenges; that playful learning supports risk-taking and over-resourcing ensures there is time and resources to support it; that the maker event adapts to its surroundings and its participants' experience even as it grows over a day; and that maker advocates promote interdependence, which may mean suppressing concerns about efficiency and facilitator competence in order to support others' learning.

Conclusion

This study examined the use of experiential learning with technology in the form of maker experiences to engage participants hands-on at a maker faire, and to build arcade tables, a 3D printer, and an alternative game controller.

The significance of this study is the exploration of hands-on experiential learning with technology with participants ranging widely in age, experience, and education in order to identify *maker competencies* to meet 21st century needs. This study suggests that initiative, playful learning, authentic adaptation, interdependence, and over-resourcing are key competencies to support maker activity. These characteristics of maker activities can be used when creating, observing, or evaluating learning experiences by asking the following questions: Did we seek to "get our hands dirty"? Did we embrace playful iteration? Did we manage in an imperfect (but authentic) environment? Did we embrace interdependence? Did we support progress over a bumpy road? And for more experienced participants in a group, did they coach more through asking questions, and do less?

While we cannot generalize the findings of this study, the maker competencies we identified are transferable to other groups of novice makers and maker advocates. Though we used a selection of the data of a large-scale research program we are conducting, the results we selected were confirmed during several workshops and are therefore credible and confirmable. This study focuses on several discrete maker experience events. Future research could engage in longitudinal study and examine the same participants over multiple events with related maker activity. For instance, the children at the community centre wished to create a multiplayer version of their arcade table, and the 3D printer offers numerous hardware upgrade and firmware coding possibilities. Such research could examine the application of our maker competencies in the creation, monitoring, and evaluation of future maker experiences including experiences wholly constructed by participants to address personal or community needs.

Acknowledgments

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Texting to Motivate Language Learning: WhatsApp Group Chats and Near Peer Role Modeling (NPRM)

Aliya Gimranova, Madina Nurmanova, and A. S. CohenMiller

Abstract

During the Soviet era, the Kazakh language underwent harsh times and was on the brink of extinction from urban areas in Kazakhstan. Today, the country is paving its way towards reviving the language. This article details an effort to support Kazakh language learning in motivating secondary school students through the use of technology. Through the development of a small-scale project connecting university students as Near Peer Role Models (NPRM) with secondary school students, we used WhatsApp texting group chats as a means to encourage authentic communication in the Kazakh language and discovered five tangible results and suggested next steps.

Background

We (the first two authors) are graduate students living and working in Astana, Kazakhstan. In this article, we detail how we used digital technology to enhance and motivate language learning for secondary school students to learn Kazakh. As part of a practice-based graduate course and larger pilot project, we used Near Peer Role Modeling (NPRM) to create discussions with WhatsApp texting groups between seventh and eighth graders learning Kazakh (one of the official languages of Kazakhstan) and university student volunteer "near peers." In using NPRM, which assumes people are naturally inclined to replicate behaviors/attitudes of those close in age/interests, we found students enjoyed learning Kazakh during the project and showed motivation for continued interaction with their "near peer" university student volunteers.

The Kazakhstani Context

The country has the ninth largest territory in the world and borders with Russia, China, Kyrgyzstan, Uzbekistan, and Turkmenistan. Having gained independence in 1991 from the Soviet Union, the official language of the country is Kazakh, yet Russian is the language used for interethnic communication ("The Republic of Kazakhstan," n.d.). Despite the fact that the Kazakh language is the official language, and therefore the language of public administration, legislation, legal proceedings, and documentation management, there is an acute problem of Kazakh language acquisition among the population (Belova, 2013). As teachers ourselves, we have seen firsthand the lack of fluency in Kazakh for many students, in particular those born in our expanding digital era. Kazakhstan is a country with 25 years of independence and more than 130 nationalities. In an endeavor to shed its Soviet past and Russian-dominated interethnic communication, the country is attempting to pave its way towards

reviving the language that is the mother tongue of the titular Kazakh nation. The government has granted Kazakh the status of a government language and Russian the status of official language. The significance of knowing Kazakh has been articulated in government programs and is mandatory in all governmental organizations. Additionally, the Kazakh language is promoted by the government due to "sentimental" reasons (Matuszkiewicz, 2010, p. 219), as both older and younger generations are concerned about their mother tongue being superseded by other languages.

Learning Kazakh

The emphasis on Kazakh language acquisition is not only a policy to promote the state language, but also considered as the most significant step for Kazakhs towards not losing the culture and the spirit of belonging. As a Kazakh language teacher explained, "Now we know more things about the whole world, about the history of every country, about geography … but we've lost something about the culture, about the language today" (Witte, 2014, para. 8). The Kazakh people fear losing their roots and their national identity that tie them strongly to the knowledge of their mother tongue. During the Soviet era, the Kazakh language underwent harsh times during the Soviet era and was on the brink of extinction from urban areas in Kazakhstan. In the late 1980s, only 11.3% of all urban schools had the Kazakh language as a medium of instruction (Fierman, 2006). Even though there have been numerous policies and attempts by the government to revive the language and expand its use across all areas before the state gained sovereignty, "Kazakh's functions continue to be limited to the household and traditional culture" (Abdyeva, Nogaybaeva, Togzhanova, & Shynybaeva, 2015).

To address this problem, one approach has been to implement the Kazakh language as a separate subject in all schools across the country. Additional approaches include governmental reforms and policies that aim to have 95% of all citizens speaking Kazakh by 2025 (Zhoyamergenkyzy, 2013). For instance, a major reform will be implemented in September 2019, where Kazakhstan plans to introduce a trilingual education policy, which is intended to contribute to the development of the Kazakh language along with English and Russian. As of September 1, 2017, the policy of teaching Kazakh as a subject has been complemented with a focus on integrating Kazakh within other lessons, with the goal of having all school graduates become fluent in Kazakh by 2020 (Kasenova, 2016). While some schools teach primarily in Russian, others teach primarily in Kazakh—these schools are referred to as Russian medium or Kazakh medium schools. In the Kazakh medium schools, courses such as Mathematics, Kazakh language, Kazakh literature, History of Kazakhstan, Geography, and a number of other subjects will be taught in Kazakh. Although it is beyond the scope of this article to discuss the consequences of introducing a trilingual education policy, there is a considerable amount of concern about the practical complexities of sustaining acquisition of all three languages by native and nonnative speakers due to existing issues in education—funding of education, quality of teaching staff, shortage of quality textbooks in the Kazakh language, the state of rural schools, and so forth.

According to Arenov and Kalmykov (1997), the Kazakh language is preferred for communication at home by the ethnically Kazakh population, but the language of interethnic communication, business,

and technology continues to be Russian. Nowadays, the influence of the English language has become even stronger than Russian in all areas of life, particularly education.

Facilitating Language Support: A Needs-Based Assessment

Within our graduate course, we were to locate a project to implement in order to support the development of the school. The topic was to be determined by those within the school and not suggested by us. The school where the project was to be implemented is a well-equipped school that has achieved high standards in teaching and learning. It has been accredited by international schools and has implemented the International Baccalaureate accreditation. Because of these high achievements, we found it initially challenging to locate a project to improve the school as most aspects had already been addressed.

Yet, with the use of a needs assessment informed by the classic work of Stephen Steadham (1980), we learned how teachers wanted help to increase students' motivation for learning Kazakh. The assessment included talking to the school's representatives, the lead instructors for the language departments, and the pertinent teachers.

Following the suggestions and recommendations made by our faculty supervisor (third author), we spent time observing language lessons and talked to the Kazakh language teachers who elaborated on what hindered learners' language acquisition, which was crucial in establishing that the learners are unmotivated with regard to the Kazakh language. We learned that those who struggled the most in Kazakh were the seventh and eighth graders. This knowledge led us to phase two of a three-phase plan for assessing needs, which included analyzing the students' needs and ways to address them, and also, measuring our own capabilities and matching them to the project's timeframe. After synthesizing the gathered data from teachers about students' needs and interests, we started to plan our project implementation.

As teachers ourselves, we have seen the challenges faced by many students in learning an additional language. For many students, while they may have grown up hearing Kazakh in their home or in the community, it is often their second or third language. During the analysis of this problem, we learned that students' struggle with learning Kazakh appeared to not be a result of teaching methodology or curriculum, but related to the motivation to learn Kazakh. It was suggested that seventh and eighth graders appeared to lack motivation related to potential aspects such as little encouragement or resources at home to learn Kazakh, lack of up-to-date, interactive, and adapted resources, and/or a result of a global trend to use English in all areas of their lives.

These potential obstacles for learning Kazakh are discussed in an article by Fierman (2006), who asserts that many parents choose schools with Russian-medium instruction (instead of Kazakh) because the quality of instruction is considered better. While there are challenges to learning Kazakh in secondary school, there also challenges within higher education institutions where there may be a shortage of textbooks for subjects in Kazakh. This has resulted in Kazakh groups using textbooks written in Russian

for their studies at universities and colleges. Furthermore, there is a teacher shortage, especially in urban areas as often teacher salaries are relatively low in comparison with other professions. Also, as state funding for education is moderate, new interactive and up-to-date resources are hard to find in the Kazakh language (Fierman, 2006). These factors contribute to creating tension within the community between pursuing personal goals of high-quality education (which is often offered in Russian) and also sustaining a sense of national identity represented by knowledge of the Kazakh language.

Recognizing Kazakh language learning as a struggle for many students and teachers, we implemented a small-scale project incorporating digital technology through the use of texting as one of the primary activities to help motivate students to learn Kazakh within the urban secondary school for gifted learners. The project's goal was to motivate seventh and eighth graders to learn the Kazakh language, which while their mother tongue, has historically and geographically been superseded by other languages, in particular Russian. All seventh graders and one small group of eighth graders were identified as students having the lowest Kazakh language level according to the school's language acquisition framework.

Student Motivation and Near Peer Role Models: A Conceptual Framework

In order to explore various opportunities for motivating learners, we consulted experts in relevant educational fields: Kazakh language experts from two affiliated organizations; our course faculty; seventh and eighth grade teachers at the school; and a teacher from the university's Kazakh language department. Based on the results of these discussions and a related literature review, we found that defining and understanding how to address student motivation was difficult. As Dornyei (2014) notes, although the term "motivation" is used frequently, often, "the meaning of the concept can span such a wide spectrum that sometimes we wonder whether people are talking about the same thing at all" (p. 518). Ultimately, we found an explanation by Dornyei (2014) and Gardner and MacIntyre (1991) to be useful for our framing of student motivation. Dornyei (2014) explains Gardner and MacIntyre's social psychological approach to motivation, which describes "integrative motivation" (as cited in Dornyei, 2014, p. 520) as a feeling of wanting to be a part of a community of speakers. Explaining Gardner and MacIntyre's concept of integrative motivation, Dornyei notes that positive feelings and attitudes towards the speakers and culture of a foreign language can enhance learners' interest to acquire integrative motivation in order to become closer or similar to the community of foreign language speakers.

Similarly, the Near Peer Role Model theory explains that people are naturally inclined to replicate behaviors and attitudes of those who are closer to us in terms of age and interests, that is, learners would more likely act like their peers or those who are a few years older than themselves, if they have a feeling of acknowledgment and respect for them (Murphey, 1998). Explaining the notion of generative learning and peer learning, Murphey explains,

> Perhaps even more valuable is knowing how to create generative learning structures that allow for quality interaction in which learners can learn from and inspire each other. Structuring classroom experiences to enhance near peer role modeling may be one of the most powerful ways teachers can enhance learning. (p. 4)

From this framework, we saw a potential way to support and increase interest in the Kazakh language by involving role models in creating classroom experiences that exist both within the formal classroom and beyond it, through the use of common digital tools that feel authentic for language learning (Gilmore, 2007)—specifically texting. Through using texting and discussions between students and near peers, language learning was introduced in a "stealth" manner (CohenMiller, 2008), within a typical conversation.

As motivation is a dynamic concept with many factors (Dornyei, 2001), we chose not to measure motivation, but to examine how NPRM can find practical applications with seventh and eighth grade language learners who struggled with motivation. We hoped to provide external assistance to teachers in motivating learners and drew from the work of Murphey (1998) and Ruddick and Nadasdy (2013), in which the researchers demonstrated that NPRM could have a positive impact on learners in a language classroom. Having been informed by the Dornyei's (2014) explanation of motivation and the NPRM concept (Murphey, 1998), we developed a framework for our project plan and implementation. This article focuses on one aspect of that project, learning with technology, in particular using WhatsApp texting groups to increase motivation.

Aiming to Increase Motivation Through Digital Technology and Near Peer Role Models

While the overall project was both to motivate language learning and assist in achieving learning objectives within the classroom, the aims of using Whatapp chat groups within the school context centred primarily on motivating Kazakh language learners in the seventh and eighth grades. The tasks of the project included improving learners' speaking skills, enriching learners' vocabulary, and lowering the language barrier—affective filter (the psychological and emotional state of the learner which may hinder acquisition of the language)—that learners might have while speaking Kazakh.

We recognized that participants involved in the pilot project were going to be essential to its success. According to the NOOA DEP Manual (2009), "In the long run, project sustainability will depend on the degree to which participants benefit directly, short-term and long-term, from the experiences or services" (p. 45). Therefore, finding appropriate peer role models was quite important. A first step involved locating near peer role models for seventh and eighth grade Kazakh language learners. As we knew of a local club at our university that centres on learning Kazakh, we approached them with our idea. After meeting with the club's president and its six representatives and presenting the concept of our project, we obtained approval for students to take part in the Near Peer Role Model implementation. The volunteers were mostly first- and second-year undergraduate students from different departments

across the university. They seemed to be very excited about this project, because it was the first time they were going to work with schoolchildren and volunteer in an external organization.

Planning the implementation of the project was challenging because of both the time limits and because we relied on resources out of our control—university volunteer club members. We had several meetings with local school teachers and volunteer undergraduate students, and constantly collaborated on appropriate dates and time ranges, because both local school students and university volunteers were extremely busy and had little time for extra activities. As a result, we managed to arrange a timeframe for three activities aimed at enhancing the motivation of the targeted learners.

We participated in the activities along with undergraduate volunteers and received assistance from Kazakh teachers at the local school. Before planning the activities, we used a basic sign-up sheet to define the common aim and how to document the progress and responsibility of all those involved.

Kazakh language teachers selected students who needed additional support in language learning. In total, 76 learners were selected with 65 students from the seventh grade and 11 students from the eighth grade. We sent a consent form and received parental consent for the students to be involved in the project prior to its implementation. Once we received consent, we arranged a meeting with the students. During this meeting, we presented our ideas and the steps involved in the activities. We shared the schedule of the activities, which would all be conducted in their Kazakh language classes with no need for extra homework or any other demands made on the students (see Table 1).

Table 1

Details of project activities

	Aims	Timeline	Conducted by	Resources
Communicative session via WhatsApp application	To organize an informal communication platform between learners and university volunteer students on various topics of interest for teenagers in order to improve learners' communicative writing and speaking skills in Kazakh and to enrich their vocabulary domain. To raise learners' motivation.	April 12, 2017 7th grade groups 1 and 2: 8:15 am - 9:15 am (2 groups in parallel) 8th grade group 1: 11:30 am -12:30 pm (1 group) 7th grade groups 3 and 4: 13:40 pm - 14:40 pm (2 groups in parallel) 7th grade groups 5 and 6: 14:45 pm - 15:45 pm (2 groups in parallel) Duration: 1 hour for each class	Project managers, university volunteer undergraduate students	Smartphones, Internet

In developing a detailed timeline, we were able to not add excessive additional work to the students' schedule, and instead incorporated it within their regular lives. This point was particularly important, as these students were especially busy with their coursework already and we did not want to add any further commitments that might deter them from wanting to learn more.

Communicative Sessions With WhatsApp Texting Groups

While we used three activities throughout the project implementation, this article discusses the use of the first one—digital technology with near peer role models referred to as *Communicative Session via WhatsApp* (other activities included an interactive oral discussion sessions in the classroom and the development of an academic Monopoly-style game, but are beyond the scope of this article). In contrast to other texting applications such as iMessage, WhatsApp has a feature that facilitates directly replying to individual texts within the group texting through nested replies. While we could have used other mobile phone text and messaging applications such as Facebook Messenger, Skype, Viber, WeChat, of which many have group chats features, we chose WhatsApp both because it is the most popular messaging app in Kazakhstan and has the additional feature that allows for nested direct replies. The common use of the application can be seen as all students had the app already installed and some students mentioned that the first app they opened in the morning was WhatsApp. Group messaging can typically become "messy" in that many topics can overlap, making it challenging to respond to a question or comment to an individual's comment clearly. WhatsApp's nested feature replies allow for a cleaner thread of responses within a group message chat, supporting clearer responses to individual questions or comments.

The idea of this activity was generated after brainstorming during a consultation with Kazakh language teachers in the school. The initial goal was to use the communication medium, focusing on the use of technology which the participants were commonly using, between the targeted students and university volunteers. We considered multiple forms, such as e-mail, forum, social media, or a common chatroom. By eliminating other options due to their potential flaws (for example, e-mail would be too personal and it is time-consuming to reach out to every secondary school student), we determined that WhatsApp was the best option as it allows creating one common chat in an app that the students use regularly; it allows sending and receiving instant messages both in group and individual format, and allows messages to be read quickly (i.e., the built-in notifications integrated with students' phones).

Additionally, there were technical advantages in using a WhatsApp discussion—simple operation, low cost, availability, and immediacy. There was also a strong educational advantage that we hoped to develop, described by Bouhnik and Deshen (2014) as, "the creation of a pleasant environment and an in-depth acquaintance with fellow students, which had a positive influence upon the manner of conversation" (p. 217). This final aspect of creating a positive environment was particularly essential, as online interaction between secondary school learners themselves and between learners and university student volunteers (the school teachers were not added to WhatsApp groups deliberately) could allow

secondary school learners to feel comfortable communicating. The fact that there was a little age difference between chat members and there were no teachers who could monitor their grammar and spelling helped to build a pleasant environment.

Implementation of the WhatsApp Texting Groups

After discussing the potential of using WhatsApp with our supervisor and local teachers, we decided to test WhatsApp as a tool to create a safe and accessible space, where local students and the university undergraduate volunteers would communicate with each other on a variety of themes, using only the Kazakh language. Texting activities between university undergraduate students and secondary school Kazakh language learners were conducted in seven groups and lasted four hours (one hour for each class). There were 10 total participants guiding the activities including ourselves and eight volunteer undergraduate students. We wanted to ensure that everyone had access to the resources needed to participate. Fortunately, with this model, the only necessary tool was a smartphone and Internet access, which all the university volunteer students and most secondary school students had. Accordingly, we had to request the list of students from their classroom tutor, develop topics for discussions, and hold preliminary meetings with the university volunteers.

The school provided us with the phone numbers of our participants and we split the secondary school students into seven groups according to their class and teacher (six groups of seventh graders and one group of eighth graders). We assigned group moderators among university student volunteers to each group, ensuring that there was no conflict with regularly scheduled classes. In the end, there were different numbers of volunteers in each chat group, which caused some difficulties, especially in groups where there were only one or two volunteers. The fewer the number of volunteers were in a group, the more problematic and chaotic it was for them to manage the discussion in a lively and engaging manner as well as to answer to every question asked by the children. This number also varied from one group to another, from 9 to 15 children. Nevertheless, we managed to handle this issue because we were taking part in every chat on our own. This is another advantage of holding online discussions. We were able to enter and exit the chats at any time. We tried to monitor the discussions of all chats, paying particular attention to the chats in situations where we felt the volunteers lacked confidence to build interactive communication.

Drawing upon research using the WhatsApp Messenger, our project followed Bouhnik and Deshen's (2014) conclusions that WhatsApp groups are usually used for four purposes: "communicating with students; nurturing the social atmosphere; creating dialogue and encouraging sharing among students; and as a learning platform" (p. 217). Table 2 provides examples of topics and questions that we included for conversational purposes.

Table 2

Examples of topics and questions

Topics in English and Kazakh	Questions in English	Questions in Kazakh
Leisure time Бос уақыт	What do you usually do in your free time?	Әдетте бос уақытыңызда не істейсіздер?
Movies/cartoons/TV shows Кино/мультфильм/телехикая	What movies/cartoons/TV shows do you like watching and why?	Қандай кино/мультфильм/телехикая көруді ұнатасыздар және неліктен?
	What is the latest movie/cartoon/TV show that you watched? Did you like it? Why or why not?	Соңғы көрген кино/мультфильм/телехикаяңыз қандай? Ол сізге ұнады ма? Неліктен ұнады/ұнамады?
	Do you like watching Kazakhstani movies/cartoons/TV shows? Why or why not?	Қазақстандық кино/мультфильм/телехикая көруді ұнатасыздар ма? Неліктен ұнатасыздар/ұнатпайсыздар?
Music Музыка	What music do you like and why?	Қандай музыка тыңдауды ұнатасыздар және неліктен?
	Who is your favourite singer and why?	Сүйікті әншіңіз кім және неліктен?
	What is your favourite band and why?	Сүйікті музыкалық тобыңыз қандай және неліктен?
Books Кітаптар	What books do you like reading and why?	Қандай кітап оқуды ұнатасыздар және неліктен?
	What is the latest book that you read? Did you enjoy it? Why or why not?	Соңғы оқыған кітабыңыз қандай? Ол сіздерге ұнады ма? Неліктен ұнады/ұнамады?
Travel Саяхат	Do you like travelling? Why or why not?	Саяхаттауды ұнатасыздар ма? Неліктен ұнатасыздар/ұнатпайсыздар?
	How often do you travel? Who do you travel with?	Қаншалықты жиі саяхаттайсыз? Кіммен саяхаттайсыз?
	What countries/cities have you visited?	Қандай елдерге/қалаларға саяхаттап көрдіңіз?
	What countries/cities would you like to visit? Why?	Қандай елдерге/қалаларға саяхаттағыңыз келеді және неліктен?
Sport Спорт	What is your favourite sport (to watch and/or play) and why?	Сіздің сүйікті спорт түріңіз қандай (қарайтын/ойнайтын) және неліктен?

These topics helped provide a framework for conversation that might feel authentic and engaging for students' language learning.

An important final decision we had to make was whether to insist on or even encourage "proper" written language. After discussion with our faculty supervisor and with each other, we decided to request that the university student volunteers not correct the grammar or spelling of the secondary school students. This decision to allow for students' own construction of sentences and spelling, even when technically incorrect, was established to both encourage greater discussion (without concern for mistakes) and address the fact that most of the local students did not have a keyboard with Kazakh letters installed on their smartphones.

By encouraging writing in general, we hoped to boost student motivation to use the Kazakh language. Thus, we decided not to discourage the students by pointing out their errors. This process of encouraging communicative practice is commonly found to be useful for teaching and learning a foreign language (CohenMiller, 2010). We found that students learning Kazakh appeared to enjoy the process of talking with their "near peer" without fear of making mistakes: "I liked this lesson/chat. It was really engaging," "Thank you for this lesson! I will be pleased to discuss with you other interesting topics next time," "We really enjoyed chatting with you and I personally learnt a lot from this one hour," "Thanks for not being evaluative and not correcting us, although I know that I made some mistakes," "Thank you for spending this time with us, I really appreciate that," "I will be looking forward to chatting with you again and to meet you tomorrow" (the next day we had face-to-face discussions with these learners, which was the next project activity, but which we have not described here, because it is beyond the scope of this article).

Overall, there were seven conversations on WhatsApp. Two conversations in each seventh grade and one conversation in eighth grade. For teaching L2 in Kazakhstan, the grades are usually divided into two. The total number of students is usually split into two groups and is taught separately by two different teachers. Texting conversations took place in seven total groups and lasted four hours (one hour for each class). In the selected school, there were approximately 24 students split into two groups, creating 12 students in each group conversation. The approximate number of lines of interaction amongst the students and university peers was 180-220 in each group (i.e., in each conversation). The WhatsApp texting groups conducted for this pilot project for school students required thorough preparation, supervision, and effective collaboration not only with the volunteering university students, but also with the Kazakh teachers at the school. The texting group was one of many activities used during the pilot project and was completed by all seventh and eighth graders who initially signed up for the project.

Texting appeared to allow students an opportunity to enjoy conversations, moving from a more passive respondent to actively guiding questions and responses. Within the texting conversations, students were able to build their ideas in a concise way in Kazakh before being "required" to respond. This allowed them a chance to both engage in a synchronous activity and have the opportunity for a delayed response to formulate their written language.

Tangible Results: Using WhatsApp Texting Groups With NPRM

Based on teachers' and our own reflections, we have understood that the outcomes of the project helped created five tangible results. First, all targeted learners participated in the instructional activities and each learner spoke Kazakh several times during these activities. Second, the project evoked interest in learners and teachers, making everyone eager to participate. Third, we applied NPRM theory by attracting undergraduate student volunteers from the university, which was effective in motivating learners. Fourth, everyone involved expressed willingness to continue the partnership. Lastly, an unexpected outcome of this pilot project was that we helped volunteer undergraduate students and local school teachers build

capacity while performing the planned activities. For instance, the volunteer undergraduate students built upon their pedagogical skills while delivering discussion and WhatsApp texting group sessions. Initially, volunteer students thought that the conversations would be built around responding learners' questions only. However, we explained to them that it would mostly go the other way round: namely, we would first need to identify the topics that might be interesting for children in this age group, which would involve as many learners as possible in interactive discussions. We also guided the volunteer students so that they would have to ask more open-ended and probing questions, be very cautious in respect to every question and response, in order to ensure they did not ask sensitive questions or offend anyone. After that we discussed the importance of giving timely and encouraging feedback to the learners, enabling them to build a growth mindset. For example, we explained to the university volunteers that praising learners with phrases like "Well done!" and "Good job!" would not be enough. Instead, they would be expected to explain to the learners what exactly was well done/written, and be more specific in motivating them. When we finished all seven WhatsApp activities, we were very pleased to find out from the university volunteers that all the tips that we gave them during our pre-activity meetings helped them build certain pedagogical skills and run the discussions more smoothly, even though none of the volunteers had been studying in the faculty of education.

What surprised us most was that students were very free and confident during the communication sessions. They joked and interacted with the university peers as their equals, and because the interaction was online, students felt less reserved on the whole.

Some students started to lead the discussion by asking us their own questions, sending pictures from their phone cameras, and asking us what we thought about their hobby of taking pictures. We found this particular feature of WhatsApp very helpful—students could share their own photos, screenshots, and videos right from their phones instantly with everyone in the group. Similarly, any information shared in the group could be saved to their phones. This saved a lot of time and helped make the communication dynamic.

Challenges Faced: Using WhatsApp Texting Groups With NPRM

While there were many positive results, we faced a number of challenges during the implementation. For instance, in such a large group of conversations we were not able to reply to every message. The lack of response from us to some messages left a few students feeling sad and/or left out. Furthermore, as we were heavily reliant on the volunteer students, there was a delay in planning and implementation as it took time to attract volunteers.

Moreover, even though we had also prepared topics in advance for the WhatsApp texting group discussions and provided the volunteers with an approximate plan for holding the discussions, a major challenge was the time-consuming nature of this activity as we had to supervise the discussions, as well as participate in them.

Reflections and Discussion

Learning Kazakh in Kazakhstan is recognized as important both to the local population for maintaining national identity and as a key element for employment as jobs increasingly require trilingual abilities (e.g., Kazakh, Russian, English). For the school where we worked, students were identified who had low Kazakh language literacy. Working with them to increase their motivation through digital learning through WhatsApp groups with near peer role models appeared to have positive effects for all those involved. This project has highlighted the potential for connecting local secondary school students with university students using digital technology as a means of facilitating communicative practice for motivating language learning.

For others interested in developing a NPRM texting group to motivate language learning, we have learned through our pilot project that the following aspects should be addressed from the beginning: ensure all students have access to the technology of choice; determine a step-by-step process for responding to students' texts; encourage a free flow of discussion by deemphasizing correction of students' grammatical usage; decide how technological challenges of texting for language in a language such as Kazakh will be addressed considering the lack of specific characters available in that language; provide a step-by-step action plan for implementation for each person involved; and create continuity with activities at the local school extending throughout the school year, paying particular attention to holiday periods (i.e., for our work, this continuity was interrupted by the summer vacation).

As initially planned, our primary aim for this pilot project was to hold activities that might motivate students to learn the Kazakh language. The intended long-term impacts and outcomes consisted of increasing language competence and assisting secondary school students to achieve learning objectives within the curriculum. In order to reach these aims, we used Near Peer Role Modeling to motivate student learning. We established a partnership between the local school and university, in particular with the Kazakh language club. We found that a project with multiple stakeholders and participants is highly time-consuming and requires enormous and detailed preparation. In implementing the WhatsApp texting group, we saw that younger school learners appeared to appreciate both the opportunity to have an alternative to traditional teaching and enjoyed interacting with the university students. Overall, we found positive reactions from the seventh and eighth grade Kazakh language teachers to the instructional activities conducted in collaboration with the university peers. Teachers expressed their hope that this partnership with students and staff from the university would continue, especially considering that a short-term project is unlikely to have lasting effects.

The use of WhatsApp was incredibly valuable for this project, because it allowed learners to be involved in informal communication with their peer models through an application with which they are very familiar. While some projects might encounter issues with student behavior in terms of sending nonsensical messages, as reported in the research by Bouhnik and Deshen (2014), our participants were found to be relatively polite and respectful to each other and with the volunteers throughout the process.

Suggested Next Steps

Considering the rapid development of technology, we recommend further exploration of potential technological options, such as sending photos, videos, and/or news links in Kazakh to build engaging contemporaneous discussions. Additionally, potential for incorporating other digital learning strategies or technologies, such as using Telegram (an increasingly common texting app in Kazakhstan) or interactive programs for group discussions (i.e., Adobe Connect), could provide video-conferencing possibilities that could greatly help in organizing communicative sessions. However, as our experience shows, the shortcoming of using videoconferencing is that it requires the use of high-speed Internet, which many students do not have access to even within the capital city.

Future projects on motivation for language learning could examine the evaluation of NPRM theory. For instance, we received positive feedback from the undergraduate student volunteers and local teachers. Future projects could include an evaluation to receive feedback from the local students involved. We believe it is of great importance to find answers to these questions: What did they think of the process? How did they perceive their learning? What did they think was beneficial and what was less beneficial? Additional studies could examine how Near Peer Role Modeling could be applied for attracting 10th, 11th, and 12th grade students to help younger learners tackle their issues in learning Kazakh or serving as "buddies" as role models and "near peers."

While we recognize that a short-term project does not automatically lead to sustained change, the project as outlined can provide a basic overview for others interested in developing collaborations between local schools and universities, complete with potential pitfalls and suggested activities. Additional research will be necessary to determine the long-term effects on motivation for language learning for this particular set of students. We are now planning our next activities for implementation in the coming semester, when the secondary school learners have a new academic school year and the university student volunteers return to their schedule. We hope this project can be the start of a long-term partnership and communication channel and collaboration between the secondary school and university in order to enhance student motivation to learn Kazakh.

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Implementing a Digital Hub Strategy:
Preservice Teacher and Faculty Perspectives

Michelle Schira Hagerman and Jessica Coleman

Abstract

An education professor and a preservice teacher candidate describe their respective insights on the design and implementation of the first iteration of an open, web-based professional portfolio project. The student's lived experience shows that for some, a Digital Hub can be a useful tool for curation, reflection, and networking; survey data suggests that not all students see value in this work, however. The pedagogical, programmatic, and research implications of this project are discussed.

Background

The English-language Bachelor of Education (B.Ed.)[1] program at the University of Ottawa prepares preservice teacher candidates for professional certification by the Ontario College of Teachers (OCT). In line with professional standards for the teaching profession (OCT, 2017), the Faculty of Education offers a rigorous, research-based program of professional preparation that equips new teachers with adaptive expertise (Timperley, 2012) that includes knowledges, skills, and ways of thinking essential to the design of learning experiences for diverse learners in complex and ever-evolving contexts of schooling in this province (Ng-A-Fook, Kane, Crowe, Karagiozis, & Hagerman, 2017). Before 2015, the consecutive B.Ed. program at UOttawa was completed in a single academic year, but in the fall of that year, new legislative mandates required all of Ontario's Bachelor of Education programs to become four-semester programs (Government of Ontario, 2016; Petrarca & Kitchen, 2017).

One of the most challenging problems to address through the B.Ed. redesign in our Faculty has been how to create learning experiences at scale that will equip all candidates to teach with diverse digital technologies for diverse purposes within a broader programmatic framework of teacher inquiry for building adaptive expertise (Ng-A-Fook et al., 2017; Timperley, 2012). There are many reasons for this, but given the changing scope and contexts for teaching and learning in our globally connected world, we must find solutions. The Internet and all of the technologies that give us access to its ever-evolving and expanding network of human thoughts, knowledge, and practices has transformed conceptions of literacy (International Literacy Association, 2017; Leu, Kinzer, Coiro, Castek, & Henry, 2013; Mediasmarts.ca, 2017; Spires, Bartlett, Garry, & Quick, 2012), of citizenship (Kahne, Hodgin, & Eidman-Aadahl, 2016), and of teaching (ISTE, 2017; Mishra & Koehler, 2006; New London Group, 1996). Programmatically, we need to find new ways to equip preservice teachers for the shifting social, cultural, and technological realities of their future classrooms, whether in bricks-and-mortar schools or virtual

ones, while also ensuring they learn frameworks for evaluating technologies for their pedagogical affordances and constraints.

Presently, students in our four-semester program can take a technology integration course in their final semester, but it is not required. Most students see a range of technologies used in the classrooms where they complete their evaluated practica, but in their university course work, the deep investigation of research on digital technologies and their uses in contexts of learning comes after their graded practica are over, and then, only if they select this course. This means that many students in our B.Ed. program likely see technology integration practices in action and even emulate them during their practica, but probably do not learn foundational theories or research to inform critical reflection on the practices they have observed or tried. Moreover, because the only remaining practicum experience in their B.Ed. program is an alternative practicum during the last three weeks of their fourth semester that may or may not involve classroom teaching, even students who opt into the tech integration course may miss the chance to put any new thinking about technologies and teaching into practice until they get a teaching job, months or even years later.

This is a problem because, although the majority of our teacher candidates are in their mid-twenties and have therefore never known a world without the Internet, we know that as individuals, they are not equally prepared to use digital tools and applications to accomplish advanced academic or professional tasks (e.g., Hutchison & Reinking, 2011; Kiili, Mäkinen, & Coiro, 2013). Research suggests that preservice teachers' print-based literacies and out-of-school uses of mobile phones, social media, and video streaming applications have not necessarily prepared them to teach with diverse digital tools (Colwell & Gregory, 2016; Hundley & Holbrook, 2013). Moreover, college-age students often struggle to synthesize multiple, multimodal information sources (Braasch, Bråten, Strømsø, Anmarkrud, & Ferguson, 2013), to evaluate the reliability of information sources (Wineberg & McGrew, 2016), and to create multimodal representations of their disciplinary understandings (e.g., Wishart, 2017).

Ideally, then, our program would offer all teacher candidates a range of pedagogically meaningful opportunities, starting in the first year, that build foundational technical skills, digital literacies skills, and enduring identities as confident, capable professionals who can leverage the affordances of digital tools and applications to support student learning across disciplines and for a range of purposes. The University of Ottawa Digital Hub Strategy (http://sites.google.com/site/edtechuo) is one initiative designed to address this constellation of needs. Launched in the fall semester of 2017, English-language B.Ed. students are now required to create a professional digital website where they curate evidence of their learning, reflect on their growth as teachers, and showcase their strengths. Determining the extent to which this strategy does or does not support our overarching programmatic objectives for teaching and learning with technologies will be the focus of long-term inquiry. In this article, however, we review research on open, web-based digital professional portfolios in preservice teacher education programs. Then, we document two perspectives on the piloting and implementation of the Digital Hub Strategy—the student view and the professor view. Taken together, our insights as the principal designer of the strategy (Michelle) and one of the first students in the B.Ed. program to create a digital hub (Jessica), shed light on the challenges, benefits, and unresolved questions about this work for our preservice teachers and faculty.

The Digital Hub at UOttawa: A Professional Web-Based Portfolio Project

As our lives become increasingly enmeshed with and shaped by digital networks, universities are creating opportunities for students to explore the complexities of online identity construction, to understand the potential of digital collaborations, and to build foundational digital and web literacies (Lankshear & Knobel, 2008; Leu et al., 2013; Mozilla Foundation, 2017). Electronic portfolio projects such as Domain of One's Own (DoOO), which was launched first at the University of Mary Washington in 2012 (Reingold & Stommel, 2016), is an example of a program that, having now spread to universities and high schools around the world (e.g., Watters, 2015), gives students their own domain name and web hosting so that they can build their own "personal cyberinfrastructure" (Campbell, 2009, p. 59).

More than an exercise in systems management, DoOO initiatives are intended to empower students, their voices, and to help them develop web literacies skills that include knowing how to participate, share, connect, protect, contribute, and work openly on the Internet (Watters, 2017). When students develop the architecture and content for their own web domain, versus working in password-protected e-portfolio or template-oriented learning management systems, they have more control over their creative work and the way it is presented to the world (Cohn & Hibbits, 2004; Fiedler, Mullen, & Finnegan, 2009). Inspired by Virginia Woolf—who asserted that for a woman to write fiction, she must have money and a room of her own (Woolf, 1929/2002)—proponents of DoOO assert that for a student to become digitally literate, she must have the means and a dedicated space where she can learn about the web, create the web, and curate the narratives of her own (digital) identity (Belshaw, 2016; O'Byrne & Pytash, 2017). Some universities pay for students to have their own web domain hosted by an independent Internet service provider (e.g., Reclaim Hosting.com, 2017). At the University of Ottawa, students have lifetime access to institutional Gmail accounts and can therefore create a Google site with their regular email login credentials for free. Candidates are also invited to explore the pros and cons of free website design platforms such as Weebly, Wix, and WordPress and to choose the platform that works best for them so that, from the start of their process, they are encouraged to critically evaluate these technologies.

Several studies have found that the process of curating an electronic portfolio is supportive of preservice teachers' learning processes (e.g., Lin, 2008; Strudler & Wetzel, 2011), especially when they have full control over their work, what they publish, and how it looks (e.g, Hartnell-Young, 2006; Parkes, Dredger, & Hicks, 2013). Recent research also suggests that when college students build a public e-portfolio that tells their story and communicates a personal brand to an external audience, they also learn to design a website, to construct multimodal messages, to use social media for professional purposes, and develop a deeper understanding of self as a professional (Jones & Leverenz, 2017). Although the study by Jones and Leverenz (2017) was not conducted with preservice teachers, the open, professional orientation of their portfolio research suggests there is great potential for similar outcomes in teacher education programs.

A study by Keenan, Rosenberg, Greenhalgh, and Koehler (2016) found that graduate students in Master's of Education and Master's of Educational Technology programs who develop professional website portfolios using "over the counter" technologies such as Weebly, Wix, and WordPress learn new

technology skills and demonstrate "a large and stable comfort level" with website authoring tools (p. 1089), even though most of them have never been formally trained to create websites. Developing a professional website also allowed participants in this study to demonstrate the depth and breadth of their technology knowledge, a core component of the *TPACK* framework (Mishra & Koehler, 2006) which describes the integrated sets of knowledge teachers use to make decisions about the integration of technologies in a learning context (cf. tpack.org). More research is needed to determine the impact of web-based professional portfolio programs on preservice teachers' development of TPACK, however.

In what follows, we offer our initial perspectives on the Digital Hub as piloted from 2015-2017. Jessica offers a single, independently authored account of the challenges and benefits of the Digital Hub for her as a student. The narrative of her lived experience shows a progression from feeling very anxious about creating a website and sharing information online to feeling confident as a teacher who can share valuable ideas and resources with her professional networks. She talks about the limitations of her skills, at first, and then offers an account of how she began to see value in the Hub. Using student feedback and survey data, Michelle unpacks the assumptions she made about the Digital Hub. We conclude with a summary of the steps we have taken to scale up the project, and with questions for future research.

Jessica's Perspective

When I entered the Teacher Education program in September 2015, I had absolutely no idea what to expect. I arrived after many years of questioning the direction my career would take. However, when I walked into my first B.Ed. course and was surrounded by like-minded individuals who all clearly shared my same love for education, I knew I was finally in a place where I belonged. I had the passion and the determination to succeed, but the content was new. Words like curriculum, universal design for learning, exceptionalities, differentiated instruction, assessment for/of/as learning, technology integration, and individual education plans were being thrown around in our classes, and for the most part I had very little understanding of these terms. The stream of new information was endless.

And then I entered my foundations course in Curriculum Planning and Assessment with Professor Hagerman. On day one, Professor Hagerman told us that we would we be learning about planning and assessment using the Ontario Curriculum, and that we would be doing the majority of our work online, using digital tools and new technologies to demonstrate our understandings. We would also be making a Digital Hub as a place to curate and compile all of our assignments. To be frank, I had no idea what a "Digital Hub" even meant, which made me feel anxious. About halfway through that first class, when I realized it meant that I would be required to design and create a website where all of my work would be posted for evaluation, the anxiety grew. I had never done anything like this before. What if what I posted was bad or wrong? What if I looked silly or sounded uninformed online? Do I even have anything meaningful to contribute? These questions and tensions remained at the forefront of my thinking as I considered the design of my website.

Looking back, although the creation of a website and the posting of my work online made me uncomfortable, the ways in which Professor Hagerman scaffolded the creation of the Digital Hub during

our time together made the whole process much less daunting, and in the end, actually quite enjoyable. This was something I had been wanting to do for some time, and I now had the space and motivation to accomplish it. Instead of just saying, "Go make a website, everyone!", Professor Hagerman led us through a series of activities to explore the variety of web-design platforms available to us, showed us examples of digital hubs created by her colleagues, and provided class time for us to begin to build our sites. She encouraged questions, open discussion of what was working and what was not, and collaboration amongst us, student to student, which was in a way difficult. This sharing of ideas and open vulnerability amongst my peers went against pretty much everything I had been through in my postsecondary schooling experience to date, but it was a welcome and refreshing change.

I began my Digital Hub by choosing the platform that seemed the most user friendly (this so happened to be Weebly, however it was a personal preference that worked for me), and adding in the basic requirements that Professor Hagerman asked of us in the course syllabus (a "Home Page," an "About Page," and a "Blog Space"). I chose a theme with bright colours, pictures of crayons and inserted an image of myself in a Faculty of Education sweatshirt, as these all represented me and my ideas of myself as a preservice teacher at the time. When it was time to post the first assignment to our blog, a synthesis of three of the Ontario Curriculum Documents, Professor Hagerman reminded us that we were all emerging, preservice teachers, and thus should frame our work in this way. As it turned out, it wasn't as difficult as I originally anticipated. On the contrary, I really enjoyed it. I started adding extra content that was not required for Professor Hagerman's course, as well as blogging about my daily activities in the Teacher Education Program. I added pictures from my practicum experiences in the classroom, as well as extra pages for the volunteer work I did, workshops I attended, and certifications I received. As I gained confidence in what I was producing and the content on my hub became richer, I began sharing my work via the professional Twitter account that I started (with Professor Hagerman and the Faculty's suggestion/encouragement), and seeking feedback from other professionals in the field of education. This whole process of "putting myself out there" was scary, but also highly rewarding. I believe that the creation and maintenance of my digital hub has prepared me to be a digitally literate educator, with the ability to reflect deeply on my teaching and learning experiences. I have gained confidence in my abilities to interact with and integrate digital technologies and tools into my teaching philosophy, which will, in turn, benefit my future students and help them to also become critical and confident digital citizens.

My interest in the Digital Hub Strategy led me to register for the optional Technology Integration course in my fourth semester. Once again, the creation of a digital hub was a central focus of Professor Hagerman's course. Although many of us had already created our professional digital presence, some had not, and so together we went through the same types of activities to begin building a site as I had gone through over a year previously. Professor Hagerman led us through what she called a "visioning" exercise, where we thought deeply about the words we would choose to describe ourselves as educators, and, in turn, discussed how best to represent these descriptions digitally. I wondered what colours, images, fonts, uses of positive and negative space would best portray me as the creative, engaging, hands-on, sports-loving teacher I wanted the world to know I am. It was through this series of activities

that my perception of my digital hub began to change and I started to think more critically about the messages I was communicating through my content and design choices.

Reflecting back, the initial construction of my hub was full of bright colours, crayons, and narrative descriptions of my thoughts and experiences in the world of education. Because I have grown as an educator, I started questioning whether my design choices were reflecting how I wanted to represent myself professionally. I began with an overall thematic shift, foregoing the bright colours and crayons, which reflected primary-level tendencies in my teaching, but did not indicate the breadth of my experiences in the classroom. Instead, I opted for a more neutral colour palette. I also thought deeply about the images I chose to include, editing and adjusting to highlight not only my teaching experience, but also my interest in technology and my academic work in the university setting. My Technology Integration course also required us to write more academic blog posts, read current research in the field of educational technology, synthesize our understandings, and ask critical questions. It was through this requirement that I was able to refocus what I projected about my professional self, choosing more to discuss my thoughts on relevant topics in education and using less of a narrative voice, recounting my feelings on the outcomes of lessons I planned for my students in the classroom. Adding more substantive commentary connected to current research allowed me to position myself differently as an educator; reading and reflecting on educational research provided greater depth to my Digital Hub, which, in turn, allowed me to demonstrate a new level of professional thinking. Although these tasks were programmatically required in order for me to demonstrate specific competencies and evidence of my learning, I was still given creative freedom over the methods of representation on my Digital Hub, which allowed me to maintain a sense of creative control over my work.

I have come to understand that the iterative process of reflection, critical thinking, creating, and producing that I used in the creation and maintenance of my professional digital space is echoed in the daily work of a teacher. I am thankful to have been given the tools and the opportunity to begin to cultivate these vital skills in a setting where creating my professional identity is not only encouraged, but also expected and anticipated, with guidance and support are available along the way. I now have a professional digital hub with over two years' worth of ideas, reflections, and evidence of my growth. I have added my Twitter feed to my site, which I have come to see as a fantastic space for networking with other professionals and sharing my ideas and experiences with other educators.

Michelle's Perspective

Occasionally, my former students expressed anxiety about putting themselves "out there," but in the Master's of Educational Technology (MAET) program at Michigan State University where I taught for several years and where I co-developed this project with colleagues, students (often, in-service teachers) learned to get comfortable with the discomfort of doing new things with new technologies for new pedagogical purposes (Hagerman, Keller, & Spicer, 2013). Thinking back, I think this is why it never occurred to me that the students in my B.Ed. courses at the University of Ottawa wouldn't see the Digital Hub as an opportunity to develop new skills, or as a space for building an identity as a teacher.

At the end of the first class I taught in the fall of 2015, I invited students to fill out exit cards. I was surprised when several comments expressed concerns about technologies and participation in an open community of learners. Comments included, "I don't like putting information online," "I have no idea how to create a blogging space," "I hate Twitter!," "Concern: Can the links we send be to private pages?" One student wrote, "I prefer to keep close control over what I put online. And, I feel that might stifle what I'm willing to put out there. Plus, I might want to save the best ideas for myself."

To me, technologies, including the Digital Hub, create contexts that serve larger pedagogical goals. My focus was on the Hub's potential as a context for networked learning and technical skills development. And yet, these goals seemed to incite worry. I wondered whether conceptions of schooling as an individual activity—or as an activity whose main purpose is to get good grades based on individual accomplishment—may have been undergirding these reactions from students too. I took a deep breath.

By mid-term, when I again invited comments and similar feedback emerged (e.g., "I am never going to be required to have to have a website as a teacher!"), I realized that for some, my expectations were raising fundamental questions about what teachers do and who they are. I realized that as these students were creating their websites, they may have been experiencing an "un-integration" of self as they "crisscrossed the boundaries between [their] inner and outer realities" (Ellsworth, 2005, p. 61). And in these moments of un-integration, some of them were feeling vulnerable. I resolved to rethink my assumptions about networked learning spaces for preservice teachers, and the way the Digital Hub project was framed for students, not because I wanted them to necessarily feel *comfortable*, but because I wanted to understand how we might frame their discomfort as a pathway to empowerment and deep learning.

After proposing The Digital Hub as one plank of a broader digital strategy in the teacher education program, the program director asked me to study students' experiences with the Hub, and present that work to the Faculty. An ad hoc committee of engaged students who had developed Digital Hubs offered salient insights. For starters, each of them reported that their main motivation to create a professional website was to gain a job market advantage. They also suggested that programmatically, Faculty could make much better use of Digital Hubs for interdisciplinary projects that could be submitted online and reviewed by multiple professors for multiple purposes. Using these insights, Jessica and I drafted a survey for all graduating B.Ed. students.

We shared the survey link through programmatic communications channels and in cohort Facebook groups. The three professors teaching the technology integration course also invited their students to take the survey, anonymously. We received 74 responses. All but one of the respondents indicated that they had created a Digital Hub during their B.Ed. program. Forty-three percent of respondents (n=32) belonged to the Imagination, Creativity and Innovation cohort but, as we summarize in Table 1, the survey did include responses from students in all five B.Ed. cohorts and all three grade-level specializations (primary-junior, junior-intermediate, intermediate-senior).

Table 1

Summary of participants by basic qualifications and cohort

Division	N	Cohort	N
Primary-Junior	41	Global Perspectives	20
Junior-Intermediate	8	Comprehensive School Health	10
Intermediate-Senior	25	Second Language	6
		Imagination Creativity Innovation	32
		Urban Communities	6

We asked students why they created a Digital Hub. As summarized in Table 2, 90% of the 74 respondents did it because they had to as part of a course. Additionally, 60% of participants indicated that it was a programmatic expectation. The third-most highly reported reason was because they planned to have a classroom website. Unlike those on the student committee who were confident their web presence would translate into a full-time position, only 24% of the survey respondents felt their website would help them to get a job. Respondents were not generally concerned with the broader skills-based or pedagogical implications for the work either. Although 39% reported making the Hub to learn new digital literacies skills, only 25% did it to gather evidence of their growth, which raises questions about whether the course-based context for the Hub project may have been limiting students' engagement or interest in the learning potential of the work. Interestingly, the students on the ad hoc committee, most of whom had active professional social media presences, and who were creating novel content to share with their professional learning networks, were convinced their websites would generate a return on investment. The 90% of survey respondents who did this work because they had to seemed less optimistic.

Table 2

Reported reasons for creating a digital hub

Reasons	N (%)	Reasons	N (%)
To get a job	18 (24.3)	It's fun	15 (20.3)
Course requirement	67 (90.5)	Learn new digital literacies skills	29 (39.2)
Reflection on my work	16 (21.6)	Plan to have a classroom website	35 (47.3)
Gather evidence of my growth	19 (25.7)	Build a professional learning network	22 (29.7)
Share my work	22 (29.7)	Programmatic expectation	45 (60.8)

The survey also asked students to share insights on the challenges and perceived benefits of their Digital Hub projects. Jessica used a process of inductive coding to construct descriptive codes from the students' responses (Miles, Huberman, & Saldaña, 2014). Together, we reviewed, revised, and defined the codes. The coding manual can be found at http://bit.ly/UO_digitalhubcodes.

Sixty-one students described the challenges they met as they developed their professional digital presence during their B.Ed. program, which clustered around four main themes: skills and knowledge, tensions related to professional identity, design, and time.

Thirty-four students said they struggled with technical skills, and realized they had to learn new technical skills to make a website. One respondent wrote,

> Challenge: Learning what platforms work best to create websites as well as learning how to use them. People often assume that our generation is immediately computer savvy, but this is often not the case so there is definitely a huge learning curve for many of us.

Several students reported general difficulties understanding how to use a variety of digital media.

Twenty-one respondents said they felt unsure about how to present themselves online as new teachers, or about sharing information about themselves on the Internet. One student wrote, "I am still unaware of what professional 'brand' I want to have out there." Another wrote, "I was also a little shy to share all of my work as I wasn't really confident because it was so new." Consistent with course feedback, another participant wrote, "I am hesitant to include too much information about myself online."

Interestingly, some students seemed to want more guidance on what to include on their portfolios, whereas others wanted less. One student wrote, "I am unsure about what information to include, the format" and another wrote,

> Too often, the content of our digital hubs was determined for us (e.g., Your assignment this week is to blog about: x, y, z). In a realistic setting, bloggers and content creators have more independence or freedom about what they share online. I think it would be more interesting to have more freedom as to what your digital hub—or some other online presence—looks like.

These contrasting perspectives suggest that flexible architecture and design recommendations could help students to feel invested in their work. Too many required posts, or inflexible recommendations for the architecture or content, may undermine the broader learning objectives for the Hub. This is consistent with other findings about student agency as a key determinant of buy-in and success (e.g., Fiedler et al., 2009; Strudler & Wetzel, 2011). Although students' Hubs could be strictly designed to align with program accreditation standards and professional standards of practice (OCT, 2017), these data suggest that prescriptive programmatic expectations for Hub content and structure could undermine student learning.

Three students noted that this work takes a lot of time. This isn't surprising, given the technical skills they also reported needing to learn, but it is an important consideration if students don't see inherent value in the work.

In terms of perceived benefits, 30 students reported that they liked how their Hubs allowed them to demonstrate their professional skills and to network with potential employers. Twenty-seven students cited increased digital literacies skills, technical skills, and increased confidence with technology integration. Nineteen students noted that they learned about sharing and participation in professional digital networks through their Hub project. One student wrote, "Got past the fear of publishing for a

public audience." Importantly, 12 students also noted the Hub as a valuable place for reflection on their professional growth. Comments included, "Understand myself as an educator" and, "A place to keep my artefacts and reflect on them. It is nice to see what I did and when." Together, these data suggest many students did perceive a gain in their technical skills, and digital literacies skills, including those related to participation in professional digital networks. And yet, six students said they saw no value in the work at all. One student wrote, "I found it difficult to make a blog without a focus. I'm not comfortable sending people to my website. It is a bunch of random articles." Lin (2008) reported a similar subset of student comments in her study. As we think about scaling this work up for all students, it will be essential to understand how to create meaningful pathways to learning for all students, including those who find the work challenging, frustrating, or at first, pointless.

Discussion

In their study of electronic portfolios as digital stories, Jones and Leverenz (2017) begin with a quote from Antoine de St. Exupéry. "If you want to build a ship, don't drum up people to collect wood and don't assign them tasks and work, but rather teach them to long for the endless immensity of the sea." It seems that the insights gained so far in our work on the Digital Hub project in the English-language B.Ed. program at the University of Ottawa have led us to consider how we might inspire a longing for a lifetime of networked learning and open reflection.

Consistent with findings from previous research, Jessica's lived experience suggests that for some students, an open, web-based professional portfolio can become a meaningful space for preservice teacher identity construction (Sanford, Williams, Hopper, & McGregor, 2012), for reflection on practice (Oakley, Pegrum, & Johnston, 2014) and technical skill development (Keenan et al., 2016; Lin, 2008). Although more research is needed, Jessica's insights on her development as a digitally literate teacher also seem to align with claims by "domain of one's own" advocates (e.g., Belshaw, 2016; O'Byrne & Pytash, 2017) who suggest the creation and curation of a professional web presence can support digital literacies learning. Jessica felt anxious at the start of this project, but was willing to push through to find meaning in the work. Others, however, did not. Future research will need to explore why or how some preservice teachers transition from worried to empowered as they create their Digital Hubs.

In light of our preliminary data, here are the strategies we have implemented so far. First, we developed a website (http://www.sites.google.com/site/edtechuo). Here, all students can learn about the vision for the project, find examplars created by other B.Ed. students, listen to testimonials, review pros and cons of website development platforms, find blog posts on particular issues and links to screencast tutorials. By design, the process of learning to create a website requires our students to read and synthesize web-based information independently, to make decisions, and to figure it out. To mitigate worries about the public nature of this work, we have encouraged students to view the Hub as a long-term project that will, and indeed should, evolve as they evolve. On the Privacy page, we offer strategies for protecting their identities as they learn. To encourage collaboration, professors who teach the required course in instructional methods and practicum planning will create opportunities to talk about and share

Digital Hubs among peers. At orientation, candidates considered how they would communicate core values and teacher qualities to others using images, content, text, colour, fonts, and video. This visioning exercise was meant to inspire thinking about their professional identity, their story, and their brand (Jones & Leverenz, 2017). Although the Hub will become their culminating evaluated portfolio, students will have full control over which content they present, the narrative they tell about that content, and the design of their space.

Fundamentally, this project is about creating a space for all preservice teachers to develop technical skills, literacies skills, and ways of thinking that we understand to be essential to their long-term effectiveness as professionals. Future research will explore whether these Digital Hubs, as introduced in 2017, support the development of preservice teacher candidates' technical skills, digital literacies, and technological pedagogical content knowledge. Further, it will be essential to understand which aspects of this project, if any, inspire our candidates to adopt the Digital Hub as a truly meaningful lifelong professional cyberinfrastructure.

Note

1. As a French-English bilingual university, our Faculty offers Bachelor of Education programs in French and English that prepare teachers to work in English-language and French-language schools in Ontario.

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Developing 21st Century Competencies of Marginalized Students Through the Use of Augmented Reality (AR)

Janette Hughes and Melanie Maas

Abstract

In this article, we share an ethnographic case study of how we worked with a small group of marginalized grades 6, 7, and 8 students to both explore and create augmented reality (AR) to produce a class cookbook. We discuss how using AR helped students develop digital literacies skills and 21st century competencies, while at the same time, integrating AR into the students' life skills component of their programming helped them also develop cooking skills and basic nutrition awareness. The findings suggest that AR has great potential in educational contexts and can be used in cross-disciplinary ways that go beyond STEM-focused programming.

Background

While virtual reality (VR), "completely immerses users in a synthetic world without seeing the real world" (Carmigniani et al., 2011, p. 342), augmented reality (AR) superimposes information or virtual objects into the real world allowing a reality where virtual objects seem to coexist in the same space with the real world (Azuma, 1997). Although AR and VR technologies have been around for some time now, they are just recently being embraced in educational contexts (Bujak et al., 2013). The authors of the 2017 Horizon Report (K-12 Edition) predict that the time-to-adoption horizon for VR in schools is two to three years and Goldman Sachs estimates that, "VR could reach 15 million learners by 2015" (Freeman, Adams Becker, Cummins, Davis, & Giesinger, 2017). Although not specifically mentioned in the Horizon Report, AR perhaps offers greater potential for student learning from a creation or production perspective. With the emergence of easy-entry, drag-and-drop platforms such as Aurasma, students can create their own augmented reality experiences with minimal effort, producing professional looking results. In this ethnographic case study, we explore the use of AR technology with marginalized students, in a non-STEM related class as another multimodal vehicle for students to develop and demonstrate 21st century learning competencies such as creative/critical thinking and problem solving, communication, collaboration, self-directed learning, and citizenship (Ontario Public Service, 2016). With Ontario Premier Kathleen Wynne's September 6th, 2017 announcement that curriculum and report cards would be updated to reflect "transferable life skills," the need to explore learning experiences that will promote the development of these skills and competencies is even more pressing than before.

Literature Review/Overview

A number of industries, including healthcare and aviation, use VR and AR to train learners in areas such as surgery preparation, driving and flying, design and development, neuroscience, and rehabilitation and teleoperation (Mihelj, Novak, & Beguš, 2014; Lindgren & Johnson-Glenberg, 2013). The benefits of learning through AR include increased content understanding of spatial structure and function, learning of language associations, long-term memory retention, improved physical task performance, and increased motivation and engagement (Bacca, Baldiris, Fabregat, Graf, & Kinshuk, 2014; Lee, 2012; Lindgren & Johnson-Glenberg, 2013; Radu, 2014). Although the potential uses for AR technologies in education are many, some educators question how schools, which have struggled to integrate even basic computer technology, will overcome K-12 technology integration barriers (Herold, 2014).

Although educational applications are only just emerging, research into educational uses of AR (and related VR and MR technologies) has increased significantly recently (Bacca et al., 2014; Chen, Liu, Cheng, & Huang, 2016; Lindgren & Johnson-Glenberg, 2013; Wu, Lee, Chang, & Liang, 2013). A number of studies have highlighted the potential for these technologies to provide deeper and more authentic learning opportunities by offering a unique mix of both real and virtual environments (Adams Becker, Cummins, Freeman & Rose, 2017; Bower, Howe, McCredie, Robinson, & Grover, 2014; Freeman et al., 2017; Lindgren & Johnson-Glenberg, 2013; Kerawalla, Luckin, Seljeflot, & Woolard, 2006; Teichner, 2014; Wu et al., 2013). The ability for these technologies to afford interaction with material in 3D, physical and cognitive immersion with learning material, and collaborative and interactive work on complex and abstract concepts, has been highlighted (Adams Becker et al., 2017; Bower et al., 2014; Lindgren & Johnson-Glenberg, 2013; Kerawalla et al., 2006; Teichner, 2014; Wu et al., 2013).

Today's knowledge-based economy requires that learners develop skills that enable them to effectively navigate and participate in our digital world (Larson & Miller, 2011; Kong et al., 2014; Voogt & Pareja Roblin, 2012; Zhao, 2015). The skill sets needed by employees today are not inherently different from those needed in the past. Changes in the job market have resulted in greater attention to the necessity of certain employability skills that have become known as 21st century skills (21CS) or 21st century competencies (Assefa & Gershman, 2012; Chu, Reynolds, & Tavares, 2016; Kong et al., 2014; Larson & Miller, 2011; Voogt & Pareja Roblin, 2012). Within 21CS, there are three general skill sets: 1) Learning and Innovation; 2) Digital Literacies (Information, Media, and Technology Skills); and 3) Life and Career skills (Chu et al., 2016). Specific individual skills further define these three general skill sets to support those aptitudes considered necessary for the 21st century (Chu et al., 2016; Voogt & Pareja Roblin, 2012).

Theoretical Considerations

AR and VR by their very nature have "the potential to both engage and excite" (Thornton, Ernst, & Clark, 2012, p. 18). As cited by Wu et al. (2013), "The nature of these instructional approaches…is quite different from the teacher-centred, delivery-based focus in conventional teaching methods" (p. 47).

According to research thus far, "AR could enable (1) learning content in 3D perspectives, (2) ubiquitous, collaborative and situated learning, (3) learners' sense of presence, immediacy, and immersion, (4) visualizing the invisible, and (5) bridging formal and informal learning" (p. 43). A number of recently published studies about AR in education have appeared and the number is increasing each year, particularly over the past four years (Bacca et al., 2014). Research into higher education and distance education has highlighted the capability for AR and VR to remove geographical boundaries and allow, "teachers and learners who are separated by distance [to] engage in social activity in learning" (Hew & Cheung, 2010, p. 34). More recently, illustrations of how AR and VR might provide experiences that are more engaging are beginning to be considered (Bower et al., 2014).

Constructivist theories suggest that learners learn better through active engagement in learning (Comstock, 2013). AR and VR can be considered constructivist due to their ability to allow students to work collaboratively and in an interactive way (Bower et al., 2014; Kerawalla et al., 2006; Teichner, 2014). There are a number of learning theories that may be considered in exploring AR and VR in education, including social learning theory, game-based learning, just in time learning, self-directed learning, and personalized learning. AR and VR environments offer information via multiple senses, such as auditory, visual, and spatial, thus providing a differentiated learning environment that may offer greater engagement, perhaps resulting in further transfer and deeper understanding.

Redefining literacy. Historically, literacy has referred to the ability to read and write. Barone (2015) highlighted foundational literacy knowledge as achieving a "full orchestration of reading knowledge – knowledge of letters and sounds, knowledge of decoding, fluency and prosody, and the integration of all elements" (p. 2). These foundational skills are a part of literacy; however, the way in which learners acquire these skills are different with technology (Downing, 2005; Barone, 2015). As information is accessed in formats outside of printed literature, the impact of technology is changing the very definition of literacy. AR and VR technologies are well positioned to inform and impact this new "multimodal literacy [which] includes interpretation of visual, written and performative aspects of text" (Barone, 2015, p. 2) as well as the development of literacy skills through the use of social networking (Barden, 2014; Barone, 2015; Minton, 2002). Literacy in the 21st century refers to more than just reading text in a printed book; it includes the myriad of ways a learner can access information and communicate through technology.

Multimodal learning. Accessing and manipulating information in multiple modes or formats including auditory, visual, and physical, or through text and non-text based means, illustrates the basic concept of multimodal learning. Considering that AR applications allow for virtual elements to be superimposed in real-world environments, it is fitting that AR (and VR and MR) technologies be considered by their very nature to hold many possibilities for multimodal learning. The capabilities for AR solutions to present information in alternate formats may provide an opportunity such as that cited by Erten and Savage (2012), to "adapt the school environment to meet the needs of an individual student, rather than making the student fit in the school system" (p. 222).

AR has been used successfully for some time now to provide simulated environments where learners in fields such as medicine, engineering, and space travel can practice various scenarios in a safe environment to learn and adjust their reactions and operations ahead of their real-world interactions (Gelenbe, Hussain, & Kaptan, 2005). Additionally, AR has been examined in relation to its ability to offer augmented feedback on learners' experiences (Sigrist, Rauter, Riener, & Wolf, 2013), as well as a promising means to address the needs of a neurodiverse population (Bacca et al., 2014). Lee (2012) predicts that as AR advances as a technological tool for learning and training, these technologies will continue to be developed and applications for education will be realized within a few years.

Methodology

Ethnographic case study. Using an ethnographic case study method, the researchers were immersed within a class comprising marginalized students who faced a variety of personal and learning challenges. This approach is conducive to this study, which positioned the teacher and student participants as coresearchers and cocreators of knowledge. We drew on multiple sources of data and used methods that prompted participants to share their meaning-making processes throughout the study.

Research Procedure

Setting. There were two primary settings for this study—a makerspace research lab in a Faculty of Education at a university in southern Ontario, Canada and a school classroom. Within the makerspace lab, there were a number of additional technologies available including 3D printers, MacBooks, iPads, iPods, programmable robots (i.e., Sphero and Ozobot), electronic circuitry components, wearable tech, and other makerspace-related materials. The school classroom was a traditional classroom that also had an interactive whiteboard and each student in the class had a school board supplied laptop (Lenovo).

Participants. The class was a Section 20 classroom, which comprises students who are part of a government approved care, treatment, and custody program. The purpose of selecting these students was to evaluate the ease of use of AR technologies while researching whether this study supported the "at promise" (Swadener, 2010) potential of these students. The findings of this study are limited due to the study size and student group.

These students come from a variety of backgrounds and have a variety of challenges including learning disabilities and/or behavioural challenges. The class of students who participated in this study comprised three girls and two boys. The students in the class ranged in age from 11 to 13, and the class covered grades 6, 7, and 8. The class included a classroom teacher, who focused on academics, as well as a child and youth worker who oversaw the students' "care, custody, and treatment" components of the program.

Data sources. Data were collected in multiple formats over the duration of the study. These sources included unstructured pre- and post-interviews, field notes, voice recordings, voice typing, and typed observations, digital pictures and video of student presentations, videos and pictures of the students' work, informal discussions, and meetings with the teacher following each session to discuss observations

from the session and future planning. Analysis of the data was completed throughout the study and was reflected upon regularly in order to analyse the students' progress over time.

Technology used. The technology used in this study included MacBook computers, Lenovo Computers, a variety of smartphones such as Samsung Galaxy S6 and iPhone, iPods, and iPads. This technology was selected based on preference for low-cost offerings and used existing equipment available in the school and makerspace.

Sequence of events. Due to the class being a Section 20 care, custody, and treatment class, students ranged in age, grade level, and skill set. As such, the research team needed to establish a common curriculum that could bridge knowledge and skill levels while effectively engaging the whole group. Additionally, because AR technologies are fairly new from a K-12 educational perspective, existing curricula using these technologies were limited. The research team's goal was to explore how the technology might integrate into existing curriculum. The study used the class's life skills curriculum focus to create an AR recipe book integrating AR technology with the life skills of health, cooking, and nutrition. As part of the creation of the AR recipe book, the students were provided with the opportunity to learn basic cooking skills, to eat healthy meals, to read and interpret a nutritional label, to expand their knowledge of healthy choices, and to acquire digital literacy skills to then translate their learnings into the creation of a recipe book that included augmentations (additional text, photos, videos). Table 1 outlines the weekly lesson plan for creating the AR recipe book, while Figure 1 provides an image of the checklist used by the class to track its progress.

Table 1

Weekly lesson plan outline for the creation of the augmented reality recipe book

Week	Focus	Description
1	Intro	Introductory Meeting with Teacher
2	Intro	Planning Meeting with Teacher Introduction to class, discussions with Instructor/First Week at university lab with Class – Intro to VR/AR/
3	Intro	Explain the concepts of AR & VR Technologies, introduction to the technology
4	AR	Introduction to Aurasma – Build your own AR
5	AR	Mr. Morris Lessmore (Read/Movie/AR) AR Elements/Anatomy
6	AR	AR Books Exploration/AR Daqri (Chemistry Blocks & Heart)
7	AR	AR Aurasma – Tutorial/Create your own Aurasma (Free Choice)
8	AR	Introduction to class Recipe Book Project – Creation of Plan for cooking, photos, recipes, etc.
9	AR	AR Aurasma – Create your own Aurasma (Healthy Choices – Before and After)
10	AR*	AR Recipe Book – Photos, Recipes, Cooking
11	AR*	AR Recipe Book – Photos, Recipes, Cooking
12	AR*	AR Recipe Book – Photo Augmentations
13	AR*	AR Recipe Book – Created recipe template so all are using the same format
14	AR*	AR Recipe Book – Recipes
15	AR*	AR Recipe Book – Photo Augmentations
16	AR*	AR Recipe Book – Cooking is finished, ensure all pictures are accessible, ensure we have all the recipes
17	AR*	AR Recipe Book – Photo Augmentations
18	AR*	AR Recipe Book – Cooking is finished, ensure all pictures are accessible, ensure we have all the recipes
19	AR*	First Print of Recipe Book – Changes, new pictures to use, challenges with augmentations, etc.
20	AR*	AR Recipe Book – Photo Augmentations
21	AR*	AR Recipe Book – Final Print
22	AR*	AR Recipe Book – Book Launch Party

Note: Use of additional software programs required for this section included: Microsoft PowerPoint and Word, Gmail, Aurasma, Microsoft Photo Editor, (cut, paste, crop, save, attach file, browse folders)

BOOK PLAN				COMPLETE		COMPLETE		COMPLETE	RECIPE AND INGREDIENTS LIST	COMPLETE
PAGE IN BOOK	DETAIL	IDEA	BEFORE PICTURE		AFTER PICTURE		VIDEOS		NEEDED	
FRONT COVER		Collage of all the pictures								
TABLE OF CONTENTS										
ABOUT THE AUTHORS		1 short paragraph about what they like/ their favourite things/ etc			First letter of their name - graphic representation					
INTRODUCTION - OUR JOURNEY		Write a story about where we started and the experience of writing and AR'ing the Recipe book								
TRIP TO THE GROCERY STORE										
SKILL 1 - ROAST CHICKEN	ROAST CHICKEN		BEFORE		AFTER		DURING		YES	
	CHICKEN QUARTERS		BEFORE		AFTER		DURING		YES	
	BONE BROTH		BEFORE		AFTER		DURING		YES	
	CHOP VEGGIES		BEFORE		AFTER		DURING		DIRECTIONS	
	CHICKEN VEGETABLE SOUP		BEFORE		AFTER		DURING		YES	
	OTHER CHICKEN RECIPES	3 FOR LUNCH 3 FOR DINNER? PICTURES OF THE MEAL (USE A PAPER PLATE TO CUT OUT PICTURES/DRAW PICTURE OF THEIR CHOICE OF LUNCH/DINNER MEAL)			OF THEIR PLATE				YES	
SKILL 2 - BEEF	BROWN BEEF		BEFORE		AFTER		DURING		YES	
	MEAT AND VEG PASTA SAUCE		BEFORE		AFTER		DURING		YES	
	BOIL PASTA		BEFORE		AFTER		DURING		DIRECTIONS	
	HOMEMADE HAMBURGER HELPER		BEFORE		AFTER		DURING		YES	
	CHILLI		BEFORE		AFTER		DURING		YES	
	TACOS		BEFORE		AFTER		DURING		YES	
	VEG/HAMBURGER SOUP		BEFORE		AFTER		DURING		YES	
SKILL 3 - SIDES	ROAST POTATOES				AFTER		DURING		DIRECTIONS	
	MASHED POTATOES				AFTER		DURING		DIRECTIONS	
	BAKED POTATOES				AFTER		DURING		DIRECTIONS	
	BOILED POTATOES				AFTER		DURING		DIRECTIONS	
	RICE				AFTER		DURING		DIRECTIONS	
	FROZEN VEGETABLES				AFTER		DURING		DIRECTIONS	
	ROASTED ROOT VEGETABLES		BEFORE		AFTER		DURING		RECIPE	
	RAW VEGETABLES		BEFORE		AFTER		DURING		DIRECTIONS	
	SALAD		BEFORE		AFTER		DURING		DIRECTIONS	
SKILL 4 - EGGS	HARD BOILED				AFTER		DURING		DIRECTIONS	
	EGG SALAD				AFTER		DURING		RECIPE	
	FRIED EGGS				AFTER		DURING		DIRECTIONS	
	SCRAMBLED EGGS				AFTER		DURING		DIRECTIONS	
	OMELETTE		BEFORE		AFTER		DURING		RECIPE	
	FRENCH TOAST				AFTER		DURING		RECIPE	
SKILL 5 - BREADS	SOUR CREAM BISCUITS				AFTER		DURING		RECIPE	
	BANANA BREAD/MUFFINS				AFTER		DURING		RECIPE	
	PIZZA	NAAN/PITA/PREMADE DOUGH			AFTER		DURING		DIRECTIONS	
CLOSING										
BOOK BINDING										

Fig. 1: Checklist by Recipe Book Chapter of Required Photos and Recipes needed for the creation of the Augmented Reality Recipe Book.

Findings

Through analysis of field notes, the study sequence of events, video, audio, and field notes, as well as written and oral student reflections, this section presents the findings related to the class's AR recipe book project in which the AR technology Aurasma (Hewlett-Packard Development Company, 2016) was utilized within a life skills curriculum. The initial demonstration of the Aurasma software highlighted the need for digital citizenship instruction when dealing with online content to discuss copyright and accreditation of others' work. The use of the Aurasma software required the research team to instruct the students on a number of basic digital literacy skills as outlined in Figure 2.

Fig. 2: Basic digital literacy skills needed for creating augmented reality images through Aurasma.

Through the use of Aurasma AR software, a wide variance in students' digital skillsets was observed and addressed through differentiated instruction. The skills the students acquired are outlined in Figure 3.
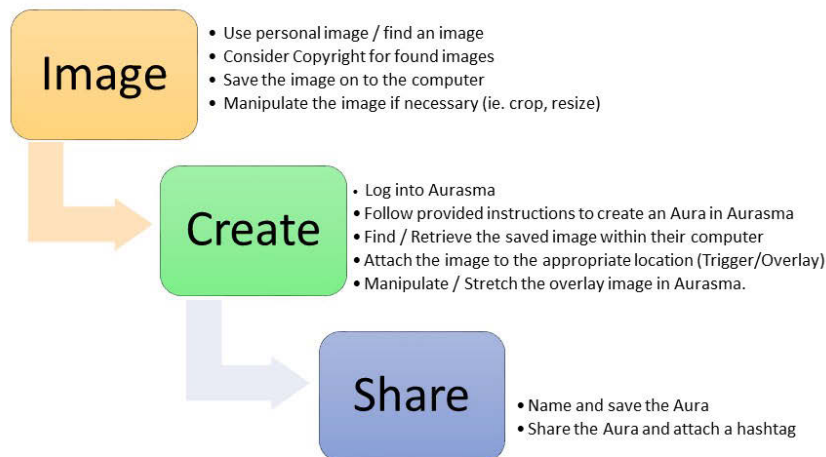

Fig. 3: Basic digital literacy skill sets acquired by students during the creation of augmented reality images through Aurasma.

Development of Digital Technology Skills

The creation of the AR recipe book incorporated the acquisition and use of digital technology skills with a life skills curriculum. The students were found to focus on the life skills curriculum while being seemingly oblivious to the technology skills they were developing and using. The use of AR was explored within this study from both creation and consumption perspectives. At the beginning of the study, the students did not understand the connection between the AR apps and the images. The study used the free AR creation software Aurasma and overall findings may serve to provide insight into effective use of similar software programs. Of key interest to the research team was that, although the students in this class have regular access to laptops, they needed very basic instruction on basic digital literacy skills in order to effectively utilize the Aurasma software and thus create augmentations.

The creation of the recipe format involved the use of Microsoft PowerPoint and Word software. The students needed to be taught how to find PowerPoint and Word on their computer, how to open these applications, how to save a file, how to name a file, how to create a folder on their computer, and how to find a file from within a different program. It should be noted these are students who have had school district allocated laptops over a number of years and are not new to laptop technology; however, they lacked very basic computer navigation skills. We found that throughout the duration of the study, common digital skills needed to be taught repeatedly as the students did not have this knowledge ingrained. There were repeated instances throughout the project involving lost documents; the student had completed the work, though they had saved the document, and on searching the computer, we often located the document in another folder elsewhere on the computer, or not at all. In instances where the file could not be found and the student was required to redo the work, the students vocalized their frustration "with the computer." The research team found that the students had ongoing trouble with naming the files with a distinguishable name as well as putting the files into a common folder. The students often created names unrelated to the file (i.e., "Trev" on a photo image of a picture of pasta), and saved the file to wherever the computer opened up.

Once the source documents were created, the PowerPoint of the recipe book and the PowerPoint of the recipe format, each student was assigned an individual section or chapter of the book for which they were responsible. Their responsibilities included the creation of the recipes for the meals as well as the related pictures. We created a spreadsheet to help the students track their individual and group recipe and picture needs. The students enjoyed using the technology and were proud of their creations, frequently wanting to show the other students the auras they had created. In the post-project interview, the teacher reflected on the creation of the recipe book and the cooking/life skills unit, commenting that,

> The decline of traditional shop based classes have had a detrimental effect on students-at-risk [who] often have limited academic successes, and these environments provide those students with positive experiential learning, and skills that they would be able to carry with them into post-secondary opportunities.

Additional observations and summary of findings are highlighted in Figure 4.

INSTRUCTION	OBSERVATIONS / INSTRUCTION NEEDS
Review other recipe books	First time many had looked at recipe book. Interest in food pictures. Excitement of the unit noted
Plan what the book should look like	Format discussions, landscape vs portrait orientation, size of paper, layout
Set goals for end product	Timelines, Where to file finished pieces for easy access
Create checklist for creation of recipe book	What pictures & recipes were needed, visualize end product
Assign roles & responsibliities	Ownership of each section of recipe book, importance of formatting and saving work
Digital literacy instruction	Find PowerPoint and Word on their computer / Open application / Save a file/ Name a file/ Create a folder on their computer/ Find a file from within a different program
	Students with board allocated technology did not have expected digital skillsets
	Need for ongoing and repeated digitial skills to ingrain knowledge
	Students repeatedly "lost" files in their computers / did not save work
	Student frustration with "technology" when they did not save/ had to redo
	Researcher intervention needed to search within computer for work saved elsewhere
	Students had trouble with naming the file and remembering what they had named it/ where they had filed it
	Students often named their files with names unrelated to the work, thus making it more difficult to find
AR RECIPE BOOK - Compiling Information	Each student had responsibility for one chapter of the book
	Organizational and executive functioning skills were needed to keep track of their work
	Use of tracking spreadsheet to assist students throughout the duration of the study
Creation	Taking / Manipulating pictures
	Creating recipes
	Saving recipe files from powerpoint to jpeg
	Creating Chapter titles and Title pages
	Ensure each recipe had multiple pictures to select from
Challenges	Use of MS Powerpoint template to create recipes was difficult to use for most students
	Students often looked to the teacher/researcher when the work became challenging - exhibiting a lack of resilience
	One student took a particular interest in cooking throughout and exhibited leadership not seen otherwise
	One student who appeared to have greatest understanding of saving/naming of files was found to have not grasped the skills and needed to redo much work
	Students enjoyed taking pictures using the ipad
	Students were observed to have sort attention when facing difficulty
	Students did not always test their augmentations
	Students lacked resilience to determine why augmentations did not always work
	Students did not transfer the difference between augmentations that worked and those which did not work
	students rushed through the creation of the recipes and needed much prodding to fix error
	Student "D" created a number of augmented pictures that he did not include in the recipe book
	Students (female in this study) who did not spend a lot of time using computers outside of the classroom, were not as comfortable using augmented reality, nor were they willing to persevere
	Some students were finished their portion of the recipe book quickly and were ready to move on to something new
	The researcher needed to provide significant group and hands on assistance to ensure the full recipe book was completed
	One student did not complete their section of the recipe book - The teacher highlighted that "students who were struggling were unable to 'fly beneath the radar' to avoid the assigned work
	Students were forced to troubleshoot, backtrack and find mistakes, as there were times when the 'teacher' did not necessarily have the answers.
Final Reflections	"I liked eating the food", and "I feel like I can cook this at home", and "I can't wait to show my dad the recipe book
	The researcher noted that the students did not focus or discuss the technology skills they had acquired through making the recipe book.
	By the end of the project, 4 of 6 students were able to complete auras without additional assistance
	At the end of the project, all students had the required skillsets to effectively navigate AR books and images

Fig. 4: Summary of observations and instruction needs throughout the AR recipe book creation process.

Development of 21st Century Competencies

Through the development of the recipe book, the students had the opportunity to both learn some basic cooking skills as well as to develop some basic digital literacy skills using the AR software Aurasma. The development of the AR recipe book provided an opportunity to develop and assess students' critical thinking through an authentic, real-world learning task. As outlined in the 21st Century Competencies – Foundation Document for Discussion, the use of immersive media and simulation to offer key transformational learning practices and contexts can offer students the ability to develop 21C competencies such as cooperation, conflict resolution, curiosity, grit and perseverance, self-efficacy, problem solving, and critical thinking (Ontario Public Service, 2016). This study using augmented reality as an immersive media revealed a number of findings specific to the development of 21C competencies

demonstrating student gains in critical thinking and problem-solving, grit and perseverance, cooperation/collaboration, and communication (Ontario Public Service, 2016).

Critical thinking/problem solving. Critical thinking and problem solving were areas of focus for the teacher to develop within the class. Due to the students' life circumstances, there were ongoing situations within the class setting that demonstrated a lack of resilience or learned helplessness. The development of the AR recipe book provided an opportunity to develop the students' confidence in health and nutrition through a practical unit on cooking. The students were asked how they were good at problem solving and what strategies they employed to solve problems which arose during the creation of the AR recipe book. Each student indicated that they would try to figure things out, but when they couldn't they would ask the teacher, the researchers, or another student for help. We observed that in the beginning, the students would often ask for help without trying to figure out a solution for themselves. Over the course of the study, we found that, with ongoing encouragement and positive reinforcement, the students would try for longer periods of time before asking for assistance. We asked the students to reflect on the strategies they employed when faced with a problem. Their responses include: "using the computer to find answers"; "I would go to other peers if they knew what they were doing. I would think back to what I did before to see if it related to what I was doing in any way"; "I've learned to breathe when I get frustrated. I need to ask for help when I have a problem. When I got stuck with the computer, I thought about what I had done before and that helped"; "I would reread the question"; and simply "Try to do it." These strategies were a definite evolution from their habit of immediately asking for teacher or researcher assistance.

The teacher also highlighted gains in her own problem solving. She commented,

> Being a part of creating the cookbook forced me to face my own limited skills with the technology. Not having to use the augmented reality program initially left me less than adept in using the program, and I found that I had to depend on the students to teach me.

She went on to underscore that the students played a big role in helping her to overcome her own problems as she reflected that, "drawing on previous learning is helpful. Knowing how to use the technology for me is so important, that I can, in turn, help my students when they get stuck."

Grit and perseverance. An important component of the students' program involves learning how to learn, becoming self-aware, developing resilience, and demonstrating strategies to overcome challenges. As previously noted, through the development of the recipe book, the students had the opportunity to both learn some basic cooking skills and develop some basic digital literacy skills (Figure 1) through the use of the AR software Aurasma. There were multiple times throughout the creation of the recipe book that grit and perseverance were demonstrated and developed. Through the final reflections interview with the students, they were asked if they felt that they were able to take responsibility for their own learning and what that meant to them. One student responded that he took ownership over his learning by "putting effort into it and being proud of my work." Another commented, "I take responsibility for the actions I make, and for my work." Reflecting on the importance of being a lifelong learner, one student said, "Learning is good; it helps you a lot. You learn many things in school. I would never cheat off something, I would ask for help." Another student commented on the importance of being responsible

to her peers: "I don't know, it's just that doing everything with my classmates, cause if I didn't do my part I wouldn't be a part of the cookbook." All of these comments suggest that the experience of cocreating the augmented cookbook not only enhanced their learning of basic skills, but also contributed to their understanding of themselves and their roles as learners.

The final reflection interview also revealed an increase in perseverance. One student remarked, "Even though something is hard I still try and not give up on it. I have second doubts but I don't give up." Another student observed, "In my old school I wouldn't do the work. Now I get more help, and get things explained to me properly" and "I put all my effort into making the cookbook." The teacher also noted, "It's all about being responsible for my learning of new technology, persevere when it gets a little difficult, and put more effort into my learning."

Interview data also suggested that students felt confident in their abilities and were able to articulate their strengths and challenges as they related to the creation of the AR recipe book. Each student highlighted their successes in creating their avatars and taking and augmenting the pictures for their section of the recipe book. The students required assistance throughout the recipe creation portion of the study where they struggled to create a step-by-step recipe themselves, as well as to then type the recipe into the provided Microsoft PowerPoint template. One student highlighted his confusion over choosing corresponding photos for his section of the book. He had augmented pictures within the Aurasma program, yet he had chosen different pictures to put on his page in the cookbook. Once he realized that the pictures he had augmented were not the ones he had selected to go into the cookbook, he needed to go back to redo his pages for the AR recipe book to ensure the pictures he had augmented were the same as the ones in the book. When the students were asked if there was anything they would have done differently, they all agreed that they would not have changed anything; although one student did note she would have changed the sour cream biscuits to something else!

Cooperation/collaboration. The development of the AR recipe book required the students to cooperate extensively with one another. They were required to work together with the teacher, researchers, and each other, to select the meals that the class would prepare. This process involved discussions ranging from the cost of the ingredients, the difficulty of the meal preparation, the availability of meal preparation space and appliances, and the amount of time the students had in class to prepare the meal. The students were further required to select a chapter of the AR recipe book for which they would be responsible for the recipe selection, the photographs of the meal preparation process, and the augmentation of the recipe book. Students were required to work together and one student in particular, who struggled with sharing his learning and expertise with the class, noted: "I did get frustrated when people wanted to use what I did and I didn't want them to get credit for what I created." This student became increasingly cooperative over the duration of the AR recipe book creation and, in the end, demonstrated notable gains in his ability to share and interact with the other students.

It is important to note that there was one instance where a student was not attending class, nor completing her work and lost the privilege of participating in the AR recipe book. This decision was not made quickly or lightly; however, the natural consequence of not being a part of the book as a result of a failure to complete

the work, even with multiple offers of assistance, was determined to be the appropriate course of action by the teacher and youth worker. This situation was a challenge for the class because the teacher was required to pick up the slack to complete the section of the recipe book that had originally been assigned to this student. The teacher then commented: "As far as *my* responsibility for the learning of augmented reality, I must admit I was lacking and would fall back on the excuse that I had so many other things to do." She found that she had not learned alongside the students and when she needed to take over the student's chapter in the book, she required assistance from the research team in the completion of the book.

Communication. Throughout the development of the AR recipe book, the students learned how to effectively navigate digital tools. They were asked how working with the researchers could potentially help them in their future learning and whether learning through technology might help in future school years. One student reflected that he felt he would have a head start for next year as he could take his learnings from this year and apply them to his integration tech class the following year. Another student indicated he knew more about technology now because he was able to navigate digital tools such as YouTube and Google to find information. A third student stated that she now knew how to augment pictures and would "probably" use AR to show her learning next year, while a different student reflected that the experience provided an opportunity to be introduced to new technology that she had not seen before. The teacher stated: "I will teach/encourage my students to use AR next year to create interesting and unique assignments" and thought that, "using AR [allowed the students] to present their learning in creative ways." One student expressed that she didn't know how technology would help her in the future.

Discussion

This study has focused on creating with AR in a life skills curriculum or "STEAM (Science, Technology, Engineering, Arts, & Math)" related context. This research suggests that the use of AR crosses multiple curricular areas as employing the creation of auras to demonstrate understanding or provide additional information is not subject specific. Furthermore, the consideration of AR technologies in K-12 schooling completed through this study has demonstrated the need to consider specific instructions on basic digital skill sets such as Internet navigation, digital citizenship, saving, naming, and retrieving and attaching files.

As new technologies emerge, their usefulness in educational contexts will be continuously examined. As demonstrated through this study, some students lack very basic digital skills that are integral to their capabilities to use AR, VR, and other digital technologies, despite our assumptions that students are proficient users of a variety of tools and programs. Preparing students today for future careers requires that those responsible for curriculum acknowledge the integral role that technology plays in both the world today and the employment prospects of the future. Regular references to how "tech savvy" today's youth tends to focus on their inherent ability to navigate social media, and perhaps their greater aptitude to pick up technology skills quickly.

Curriculum connections and using AR technologies in the classroom. This study has demonstrated that AR creation can be integrated into a life skills / food curriculum and has highlighted the potential for AR to cross multiple subject and curriculum areas. The teacher in this study reflected on the learning that occurred through the development of the recipe book,

> The potential for students to direct the learning process from the beginning to end – design to producing the end product, should be the practice in the classroom. It would afford students the opportunity to connect to the experience in ways that the teacher-directed approach would not.

Furthermore, the teacher noted that this kind of inquiry-based project helps facilitate the development of important transferable skills or 21st century skills.

> These projects are a perfect opportunity to observe the learning skills students are using – collaboration, responsibility, initiative, organization, independent work, self-regulation – which are crucial to student development, and projects such as these serve to provide opportunities to grow in these areas … Students at risk are already at a disadvantage in finding employment upon graduation from high school. Increasing the educational requirements for apprenticeship programs, coupled with not providing early education/exposure to technology, will only serve to further minimize their ability to succeed.

These 21st century skills have also been called "soft-skills" or noncognitive skills. We argue that this is a misnomer and suggest that these transferable skills are the permanent, lifelong skills that students need to develop to be successful, not only at school, but also at work and in life.

Need for a deeper understanding of technology. Although technology is prevalent in youth's lives today, there appears to be a superficial understanding of the technology itself. This is not a generalizable statement as there are obviously many youths who have significant skill using digital technologies. Educators need to determine what role schools should play in the development of a common digital skill set. Emerging technologies such as AR can only be used effectively when students have a basic level of digital understanding and skills. The lack of uniform instruction in these basic skill sets was evident in this study. For this group of marginalized students, this was especially troubling as the students in this study have daily access to school district supplied laptops intended to support their learning.

Conclusion

Many examples already exist to display where the future of AR may take us. The release of Nintendo/Niantic's Pokémon Go in July 2016 resulted in the global adoption of augmented reality (AR) technologies, almost overnight (Ore, 2016). In what can be best described as a rapid, perhaps herd-like, diffusion (Rogers, 2003), Pokémon Go gathered an estimated 21 million users in the first two weeks in the United States alone (Sillis, 2016). The collision of technology advancements and increased smartphone user base created the perfect storm for the diffusion of AR technology through Pokémon Go (Poushter, 2016).

AR apps such as 4D anatomy and 4D Elements provide augmentations of the human body and heart, as well as elemental chemistry (Daqri, 2016a, 2016b). Aurasma and Layar allow students to develop

their own augmentations easily through free and accessible software offerings (Hewlett-Packard Development Company, 2016; Blippar, 2016). As Lin et al. (2016) point out, "AR technologies can take any situation, location, environment or experience to a new level of meaning and understanding" (p. 51), while augmenting the real world in real time, potentially applying a sense of smell, touch, and hearing (Carmigniani et al., 2011). These technologies allow learners the opportunity to learn in dynamic hands-on ways, shifting instruction from passive observation to active learning. As highlighted in the 2017 K-12 Edition of the Horizon Report, the advance of technology is not only providing new considerations and tools for instruction, but also new opportunities for multidimensional assessment (Freeman et al., 2017). AR (VR and MR) technologies may also lend themselves well to the provision of authentic learning opportunities through learner immersion via augmentation and simulation of real-world environments and scenarios (Freeman et al., 2017). The development of digital literacy skills and greater understanding of digital citizenship are both areas which may benefit from the use and creation of AR. Wu et al. (2013) highlight that in the future, consideration of AR should not be limited to a type of technology, but rather that one should consider AR as an "affordance[] of the real world [which provides] additional and contextual information that augments learners' experiences of reality" (p. 43). An augmented world offers many exciting and intriguing opportunities for learners today and beyond.

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Educating About and For the Future

Deanna Kuhn

Abstract

Education for citizenship is more important than ever. The author describes a technology-supported curriculum that engages young teens in electronic discourse with peers on significant personal and societal issues and assists them in decision making on topics ranging from their personal futures to the futures of their communities, nation, and world. A further purpose is to use discourse as a bridge in developing the individual argumentive writing that students of all ages find so challenging.

Background

With the world in increasing turmoil, what could be a more important educational mission than preparing students to address the critical issues that will confront their generation as adults? Yet few pre-college classrooms engage students in debate of serious issues of the day, arguably the best practice to prepare them to address such issues as adults. Education for thinking, a foundation for citizenship, is widely viewed favorably in principle, but remains shortchanged in practice.

The social studies curriculum would seem the natural place for students to debate issues of concern to the society they live in, but doing so is largely crowded out by the traditional curriculum, regrettably not much of which sticks. (A recent Facebook video showed US college students clueless when asked who won the Civil War.) The implicit message teachers convey is that knowing about the past warrants more attention than contemplating the present or future.

Why not address the future? It surely deserves as much attention as the past. If future 21st century citizens are going to think deeply about the issues that will face them, rather than rely on the slogans and sound bites that too often pass for thinking today, they need the practice that will prepare them to do so. And in making reasoned decisions about important issues affecting their individual and collective lives, they will develop identities as citizens with the capability and recognized responsibility to do so.

These are the considerations that led to our development of a technology-supported curriculum to develop argumentation skills in middle- and high-school students through their engagement in electronic debate with peers regarding authentic contemporary social and socio-scientific issues. It is described in a book for teachers, with embedded video illustrations, *Argue With Me* (Kuhn, Hemberger, & Khait, 2016), and in a new book, *Building Our Best Future: Thinking Critically About Ourselves and Our World* (Kuhn, 2018), written directly to 6th-12th-grade students. In the latter, students choose from suggested topics under the headings *A Personal Future* (e.g., When you finish high school, you have the choice of going right to college or of working for a few years first), *A Community Future* (e.g., Should all teachers

receive the same pay or should teachers with more skill or experience be paid more?), *A National Future* (e.g., Should people pay a social security tax from each paycheck to provide money when they retire, or should people save on their own for their retirement?), and *A World Future* (e.g., Should a powerful nation intervene to help another nation in trouble or focus only on its own problems?). Each such issue they engage deeply in a variety of formats in collaboration with their peers.

Are typical young adolescents, including even the many academically disadvantaged ones, underserved by inadequate schools, capable of addressing such questions? Our experience documents that they are eager to do so and thrive in a context that is student-, rather than teacher-centered, and in which they develop for themselves with time the norms that govern serious discourse. But their range of experience and awareness needs gradually to expand. I asked a class of inner-city middle schoolers before the 2016 US presidential election what the major problems were that the new president would face, and most identified just two: homelessness and stealing. On the topic of allowing use of animals in research, middle-schoolers we've observed often come up with the idea that human prisoners would be a better choice for this purpose since they are guilty and animals are innocent. But such ideas self-correct with continued discussion, without heavy-handed intervention by the adults who largely play a coach role. And they gradually broaden their knowledge, in ways I describe shortly.

A Technology-Based Argumentation Curriculum

Our approach to developing argumentation skills, and the values to support them, is based on the view that this development necessitates sustained and dense practice in rich environments that require those skills and values. It requires both a supportive community and the strengthening of individual skills and understanding. Hence it is not quickly achieved.

Core features of the method are that it is student-centered, emphasizing peer-to-peer, rather than teacher-centered interaction, and technology-based, although of a low-tech sort no classroom teacher would be intimidated by. Underlying it is a commitment to the view that high-level intellectual skills such as argumentation are sufficiently important to warrant dedicated attention in their own right as curriculum goals. Our approach is consistent with the sociocultural tradition of Vygotsky (1978) and other more contemporary authors (Resnick, Michaels, & O'Connor, 2010) in taking the everyday social practice of argumentation as a starting point and pathway for development of individual argumentive thinking and writing. In Vygotsky's terminology, the inter-mental with practice becomes interiorized and transformed into the intra-mental.

Students engage deeply with a series of challenging topics, each one over as many as 12-13 class sessions. They engage in two forms of peer discourse, the first one verbal and beginning with same-side peers who prepare for dialogs with successive opposing-side peers that follow. The same-side pair must agree in advance on what to communicate to the opposing pair. This essentially doubles the participation in reasoned discourse (both verbal within the same-side pair and electronic between opposing pairs). Both types provide an opportunity for metacognitive planning and reflection (since the pair must reflect on the opponents' statements and debate what to say to them in return).

The technology dimension of the curriculum comes into play with the second form of discourse. It centers around dialogs conducted electronically between the same-side pair and a succession of opposing pairs. Most students are already very familiar with electronic communication and they enjoy having it brought into the classroom. Yet that is not our primary reason for employing it. Electronic discourse provides a written record that externalizes thought into a tangible form, in contrast to verbal discourse, which disappears as soon as uttered. The electronic medium thus facilitates reflection on what is exchanged, taking discourse temporarily "off line" (Olson & Oatley, 2014). In addition to serving as a reference point and framework during the dialogs, these transcripts become the object of various reflective activities that students engage in (Figures 1 & 2). The sequence of activities culminates in a whole-class "Showdown" debate, debrief analysis of the debate, and, last of all, individual final essays on the topic, in the form of a newspaper op ed.

Fig 1: Own-side reflection sheet

Fig. 2: Other-side reflection sheet

In their discourse with one another, students will not be able to generate rich arguments and counterarguments in a vacuum. They need to bring to bear information relevant to the topic to inform their reasoning. They will likely already have some degree of knowledge that they are ready to summon to support their arguments (or to weaken those of their opponents). But they will need more knowledge than they have at the outset. One approach might be to ask students to begin their work on a topic by reading material about it. A drawback of this approach is that students don't yet appreciate the purpose that this information serves. In a word, it provides answers to questions they don't yet have.

As a result, they fail to see its point. They are thus likely to approach such reading disinterestedly, as just another reading assignment to complete.

A small dose of initial reading can be productive, to arouse interest in the topic, but at the outset we employ it sparingly out of concern that a deluge of information up front not only is met with disinterest, but can also shut down students' own thinking and inquisitiveness about a topic. Therefore, we let students' own ideas dominate at the beginning of their engagement with a new topic, encouraging them to articulate and share with one another their ideas about the topic. And, we have found, they do have lots of ideas to share, even in the case of topics outside the range of their immediate experience.

Still, students' discourse needs to be informed and enriched by information new to them bearing on the topic. An effective way to do this, we have found, is to first create a need for the information they acquire. Rather than provide answers to questions students don't have, we have them first formulate the questions. In this way, we allow students to first see how such information could be useful, and then we assist them in securing it. Hence, after introducing a few basic questions and answers regarding the topic, we invite students to generate questions of their own, the answers to which they think might be helpful. By the next session, we then make available brief factual answers to these questions (which students may assist in obtaining), and the resulting question-and-answer "evidence set" (containing all questions and answers) is made available for use by the entire class throughout their work on the topic. The point is for students not just to acquire information, but to see its value (Figure 3a) and therefore be disposed to apply it (Figure 3b). With practice, we have found, students do in fact in time make much use of this information, coming to recognize it as playing a critical role in their discourse.
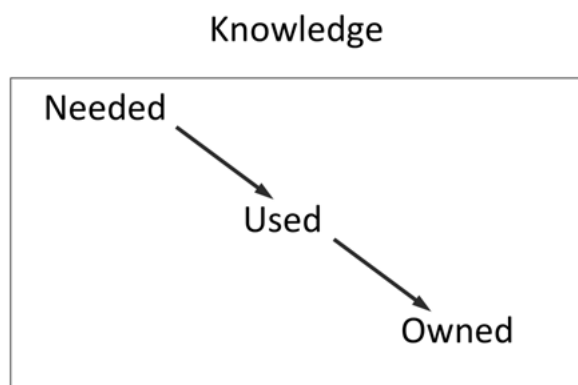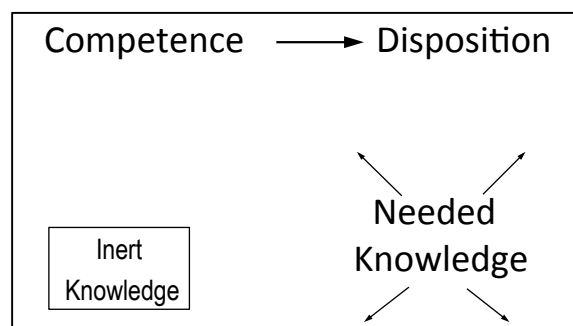

Fig. 3a: Value of information

Fig. 3b: Application of information

That activities center around peer interchange (Figure 4), rather than whole-class, teacher-directed talk (Figure 5), helps to promote the objective of students becoming accountable to one another, as members of a community with evolving group norms. Students are constantly on call, needing to respond to one another. In whole-class discussion, in sharp contrast, students can fade in and out, raising a hand now and then, but the rest of the time assuming the passive role of audience. These evolving norms are constructed within the group and gain acceptance as expected behavior on the part of its members. Claims are expected to have reasons and these reasons must stand to the challenge of strong arguments and evidence that may

weaken them. Shared understandings evolve of what acceptable counterarguments consist of and what counts as evidence, and group members risk criticism for violating them.
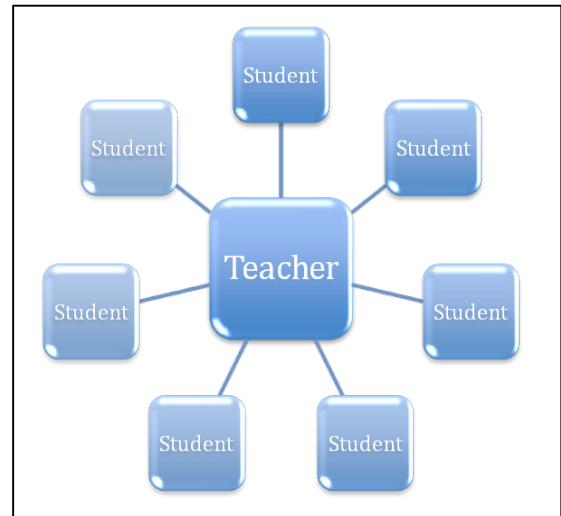

Fig. 4: Peer interchange activities

Fig. 5: Teacher-directed talk

Argumentive Writing

Students of all ages find expository writing notoriously difficult. Why is our dialogic method successful in yielding essays like that of the middle schooler's illustrated in Table 5? We believe this is so because our dialogic focus supports the development of individual written argument by giving the latter a purpose. In addition to the final "position" piece they write individually at the conclusion of a topic, students write regularly in their electronic communications to opposing pairs. This writing has a very specific and focused communicative purpose. Students also have the support of a same-side partner to collaborate with, as well as a context in which to reflect together on what they are going to say to an opposing pair.

All of these factors, our studies have suggested, contribute to students' success when they are asked to write a more conventional individual essay. Experiencing a flesh-and-blood interlocutor and a purpose to the exchange they engage in leads the way for students to interiorize this dialogic frame when it comes time for them to express themselves individually in writing. Students are no longer writing to or for a teacher, seeking to produce what they think the teacher is looking for. Instead, they engage with their peers—first electronically and then in person. Later, in individual writing, this discourse remains alive, although confined now to their own thought, when they envision what another might say and how they can address it. The dialogic structure apparent in the essay seems key. The continuing experience of dialog with a succession of peers holding the opposing position makes the opposing position and its accompanying arguments clear and vivid enough so that the student writing an individual essay can represent them in the essay and address them, and, moreover, sees the relevance of doing so.

Evidence for Effectiveness

Of interventions that have been introduced to promote development of K-!2 students' argumentation skills, we believe ours to be among a very few having the soundest, most extensive documentation of outcomes. We have implemented the program for periods of up to three school years at five New York City public middle schools, as well as in schools in several locations outside the US. Our most extensive database comes from a Harlem school in which a total of 12 classes worked with us for two class periods each week for two to three years. Of the three class sections in each cohort, two participated in our curriculum. The third section participated in a comparison class equivalent in time and work investment but following a more traditional whole-class discussion format, along with writing assignments and some role-playing activities, based loosely on a Philosophy for Children model (Lipman, 2003).

Discourse. At annual assessments, a pair who held opposing views on a topic not part of the curriculum conducted a dialog via a "Pass-the-Pad" method (the written document passed back and forth the pair's only mode of communication) used so as not to handicap the comparison group, whose activities didn't include electronic discourse.

We classified each statement students made in the Pass-the-Pad document according to whether it "countered" the partner's immediately preceding statement. These proportions rose with each yearly assessment among the participating group, but not among the comparison group (Figure 6). Importantly, when these gains are broken down by initial skill level, the one third of the dialogic group that showed least skill at the initial assessment continued to improve during the third year to almost the level of their initially more able classmates, establishing not only that the curriculum works, but that it also works very well for low-performing students.
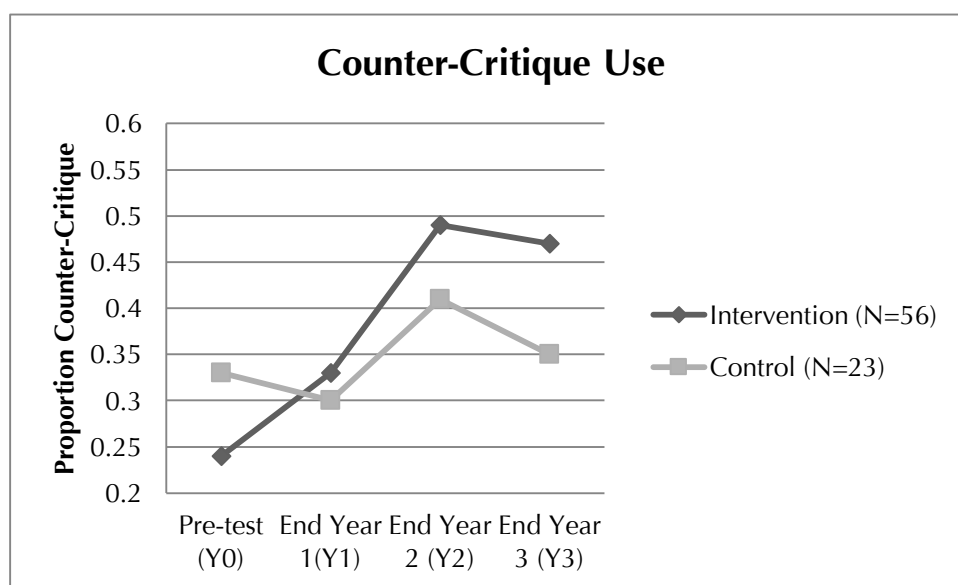

Fig. 6: Development of dialogic argument skills over time (from Crowell & Kuhn, 2014)

Equally revealing are our qualitative data indicating the extent to which students who began with shallow electronic exchanges, mixing substantive exchanges with meta-talk about what they were doing (Table 1) came to uphold norms of discourse with respect to both the same-side verbal discourse (Table 2) and their electronic discourse with opponents (Table 3; Kuhn & Zillmer, 2015; Kuhn, Zillmer, Crowell, & Zavala, 2013). As further evidence of the power of a dialogic method, direct comparisons of students' electronic discourse and their individual writing showed two differences. In discourse, they more often brought their own knowledge to bear and they more often addressed the opposing position (Kuhn & Moore, 2015).

Individual writing. We also have documented gains in students' evaluation of arguments and in their construction of hypothetical two-sided dialogic arguments (Kuhn et al., 2013), but the outcome measure of greatest interest to educators is students' individual argumentive essays, where they also show gains (Kuhn & Crowell, 2011; Hemberger, Kuhn, Matos, & Shi, 2017). At annual assessments, students wrote an essay on a new topic. Gains were evident both over time and relative to the comparison class, for both dialogs and essays (Table 4). Details are available in these publications and in summary in Kuhn et al. (2016) and Kuhn (2018).

Conclusions

The seeming success of our approach by no means implies that other approaches are misguided. Standing in contrast to our experiential pedagogical emphasis are approaches that advocate explicit instruction as a tool in developing critical thinking and writing. Moreover, there now exist a number of electronic tools designed to scaffold students' efforts in constructing and evaluating arguments. There is no reason to think that explicit writing instruction will not be of additional benefit to students in further developing their argumentive writing. Indeed, the metacognitive reflection on their dialogic exchanges that our intervention encourages should help to prepare students for explicit reflection on their writing. We see our approach, rather, as addressing the building blocks of argumentive thinking and writing, and here we see extended engagement and practice as the essential foundation.

Another contrast has to do with the goals of argumentive writing, specifically whether the emphasis should be an adversarial or a consensus seeking one. Some researchers have advocated consensus-seeking as the more productive objective (Scardamalia & Bereiter, 2014; Felton, Crowell, & Liu, 2015). However, other researchers have presented evidence that an adversarial form is more productive (Iordanou & Constantinou, 2015). Our view has been that the adversarial frame prepares for the consensus-seeking, by sharpening relations between claims, but this is a question that warrants further investigation.

We are currently involved in further study of our method in which we subtract different features of the intervention in order to isolate which of its characteristics contribute most greatly to its strength. For now, we can say only that we believe its success is attributable to its two core features.

One is its roots in dialog and the other is the deep engagement with significant topics that the young students who participate experience.

The mention of significant topics leads us back to the concerns introduced at the outset. Young people need to engage individually and with one another in contemplating the significant issues of their time, not only for its dividends in developing their minds. It is also critical in developing their skills and responsibilities having to do with citizenship. A point of view is indeed likely to be missing to the extent that it has never been exercised (Figure 6). The reasoned discourse of today's young people will be urgently needed in coming decades, and we should do all we can to develop it.

Table 1

Electronic dialog between two pairs early in the intervention

H1.	hi, who is this? why are you for the town school? Are you on yet?
T1.	yes im on are u on
H2.	state your case
T2.	nick should go to town becuz he needs to learn
H3.	Even though he needs to learn he will hard time because he doesn't speak english
T3.	he can learn english over there
H4.	but his parents would still be better teachers because they know him better, by the way we're ashley and nancy
T4.	I no ur ashley and im jeffrey and eduardo if the parents are teaching him they wont get enough money to buy thier food for the family
H5.	Are you at lost for word and who is your partner the parents could work at the school or get the money from the government
T5.	No its jeffrey and eduardo what if the government doesnt give any money or dont give enough
H6.	is eduardo contributing?

Table 2

Sample of mid-intervention verbal dialog between same-side partners

What should we start out with?	Is there any evidence for this?
I'm just thinking of the other side, of what they're gonna say?	But we need to use evidence.
Can you read me that again, their counter?	Why should we use that evidence?
What does that mean?	Did they use any evidence for that?
That's not making any sense.	How's that helping them?
We don't know.	What do you think?
	So what can we write?
	But it doesn't connect to what they said.
	We should've written something else.
	You just improved that argument.

Table 3

Sample of late-intervention electronic dialog between opposing pairs

- ❑ A: you can't prove that.
  B: we have evidence
  A: where is it? Tell us then.

- ❑ Your argument is faulty. There is no evidence.

- ❑ I said "may", which indicates that I do not know if they are.

- ❑ There is no proven evidence for your statement and you are using examples from your personal life that might not apply to everyone.

- ❑ You are only looking at one perspective, which is the negative side of adult systems. You aren't looking at it both ways.

- ❑ What I'm saying is that you aren't seeing both sides of the argument.

Table 4a

Percentages of participants making dual-perspective and integrative arguments by time and condition (teacher pay essay, initial sample)

	Initial		Year 1		Year 2		Year 3	
	E	**C**	**E**	**C**	**E**	**C**	**E**	**C**
Dual-perspective arguments	35	35	67	38	79	19	79	29
Integrative arguments	00	00	00	00	00	00	30	00

Table 4b

Percentages of participants making dual-perspective and integrative arguments (teacher pay essay, replication sample)

	Experimental group			Comparison group
	Initial	Year 1	Year 2	Year 2
Dual-perspective arguments	30	54	73	38
Integrative arguments	00	03	14	00

Note: Sample size is 37 experimental and 21 comparison. E=Experimental; C=Comparison (From Kuhn & Crowell, 2011).

Table 5

Sample final essay

> • [S30] I think that Juveniles should be sent to a juvenile court because of the immaturity they still have [M+1]. For example, a human's prefrontal cortex isn't fully developed until the age of 25, therefore they still don't have the full "intelligence" to make completely well thought out intelligent decisions until then [M+1]. **On the adult side of the argument they argued that the brain doesn't have to be fully developed to make educated decisions** [O+1] **they are smart enough to understand right from wrong** [O+2]. Also, in adult court it is the same as in juvenile court, you go to court, there is a jury and there is a judge that tells you if you are "guilty" or "not guilty". **In response to that, they may be the same court-wise** [O+3] **but the consequences given are very different in both. If you are guilty in adult court you can spend almost your life in jail** [O–3], **but if you are in juvenile court you could spend up to a couple of years in juvy** [M+2]. In adult court it teaches the juveniles a larger lesson and discipline [O+4] and they have a lot of time to think about what they had done [O+5]. **In response to that, the larger amount of time spent there the larger the influence** [O–4]**. The influence brought about in adult jail can scar the juvenile for life** [O–5]…

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Blended Learning and Data Use in Three Technology-Infused Charter Schools

Ellen B. Mandinach and Ryan C. Miskell

Abstract

This study examined how the affordances of technologies in the blended learning affected teaching and learning activities. The study used mixed methods to examine whether the blended learning environments provided enhanced access to and more diverse data for teachers and students from which to make educational decisions. The study found that the technologies provided more diverse data to administrators, teachers, and students and allowed for flexible adaptations to virtual and face-to-face learning to meet students' needs. The blended environments helped to create data cultures within the schools where educators used data to communicate and have an impact on instructional activities.

Background

This paper explores how the affordances of blended learning environments provide data for educational decision making to educators and students that might not be otherwise available. Because blended environments have significant technology infusion, technologies are likely to yield data that can assist educators to inform their practice in formats and real-time feedback loops not possible in more traditional settings, while also engaging students to examine their own data. Blended environments may alter the structure of classrooms by changing how instructional activities are delivered and by making the role of students more active in the teaching and learning process.

Blended learning has become an emphasis for policymakers. It is seen as the customization of educational and instructional activities to address individual students' needs. Yet Cavanagh (2014) notes, there still is no common definition. The Data Quality Campaign (2016) noted the importance of blended environments, the technology, and the resulting data, to customize instruction to meet the needs of all students (Guidera, 2016; Holiday, 2016; Messer & Polis, 2016; Perdue, 2016). Such environments provide for real-time data, teacher and student empowerment, immediate course corrections, the use of data to individualize for every student, and connectivity to reach all students regardless of circumstances.

Research on blended learning has begun to emerge. In particular, the research reported here is informed by the work of Pane, Steiner, Baird, and Hamilton (2015). Using a multi-method approach, the RAND research identified five domains and 13 attributes of blended learning:

- Learner Profiles
  - Personalized goals for students
  - Student data provided and discussed with students
- Personal Learning Path
  - Outside of school learning
  - Flexible/multiple paths for students through content
  - Individual student support
- Competency-Based Progression
  - Student progress through content based on competency
  - On-demand assessment to demonstrate competency
- Flexible Learning Environment
  - Student grouping
  - Learning space supports model
  - Structure of learning time
  - Extended learning time for students (extended school day or year)
  - Technology available to all students
- College and Career Readiness
  - Developing college/career preparation skills

Affordances

Achieving the aims of blended learning is a formidable goal. To do so, *i*NACOL (Patrick, Kennedy, & Powell, 2013) posits several affordances that should be incorporated into blended learning models.

Highly personalized, customizable, and student-centered. The learning environment provides students some control over how they learn. Instruction is differentiated, pacing is flexible, and interventions and supports for students are available on demand. Learning environments should respond to student needs and interests, be developmentally appropriate, and be informed by data and based on the science of teaching and learning.

Competency-based and rigorous. Learning objectives are explicit, measurable, and align with college and career readiness standards. Students should be able to demonstrate their mastery at any time, without having to adhere to a rigid instructional pacing schedule.

Data-driven. Instruction to facilitate student learning should be informed by frequent and varying forms of meaningful formative and summative assessments. These data can be delivered in real time. Additionally, other sources of diverse data are made possible. An essential component here is that the technologies provide both teachers and students access to a wide variety of data made possible by technology.

Equitable and accessible. Students are afforded access to courses, experiences, and teachers that they otherwise would not have (e.g., remote communication) as well as multiple methods of instruction and digital content (Aspen Institute Task Force on Learning and the Internet, 2014; Fernandez, Ferdig, Thompson, Schottke, & Black, 2016).

Staffed "flexibly" but capably. Flexible staffing permits instruction and learning to happen any time.

The possibilities afforded by blended learning are stimulating growing interest in effectively using technology to support appropriate teaching, learning, and assessment environments. With sophisticated tools, educators can harness information from a wide variety of sources, including from the "digital ocean" (DiCerbo & Behrens, 2014), to achieve the goals of blended learning (Bienkowski, 2014; Bienkowski, Feng, & Means, 2012). For example, innovations in flexible learning technology aspire to incorporate information about individual students such as prior academics, prior and real-time cognition, on-task and perseverant behaviors, among other data to adjust digital learning environments for individual students (Abell, 2006; Fletcher, Scaffhauser, & Levin, 2012).

There are several key advantages here. First, teachers and students save time through access to data and resources that may or may not be available without the technology in a cost-effective manner. Second, the diversity of data provides teachers and students with data that might not be available in traditional classrooms. Third, the data arrive in real time, providing tighter feedback loops among instruction, assessment, data collection, analyses, and interpretation. This iterative cycle means that data collection and feedback are much more tightly woven to the teaching and learning process.

Trends

Although the history around blended learning is not particularly long, it is possible to discern patterns and trends that are emerging. DreamBox (2014) identified 10 trends:

- Deeply student-centered learning experiences;
- Soaring numbers of digital learners;
- Supporting standards and higher-order thinking skills;
- Realizing benefits for students and teachers;
- Data-driven instruction to personalize learning;
- Personalized learning accompanied by a blended iterative approach;
- Productive gamification;
- The mobile world is where learners live now;
- Bring Your Own Device (BYOD) capacity; and
- More broadband. (p. 3)

Some of these trends are relevant to the work described here. For example, creating a student-centered environment requires active engagement on the part of learners. Similarly, a focus on higher-order skills requires students to engage in deeper cognitive activities with more creativity and less passive

learning. Engagement affects not just students, but also changes the role of teachers. Blended environments tend to be more active, in classrooms and with virtual connections. They also provide data that heretofore might not be readily available in real time that allow for customizable teaching and learning experiences. Finally, with the proliferation of mobile devices, emerging technologies, and more ubiquitous connectivity, blended environments provide for more flexibility throughout the teaching and learning process.

When the U. S. Department of Education (2016) released its most recent national education technology plan, blended learning loomed large. The plan emphasizes the role of technology in the design of teaching and learning activities and notes that:

> Teachers collaborate to make instructional decisions based on a diverse data set, including student and teacher observations and reflections, student work, formative and summative assessment results, and data from analytics embedded within learning activities and software aided by real-time availability of data and visualizations, such as information dashboards. (p. 41)

The plan also emphasizes the role of technology for assessment, providing new and more innovative means by which to measure learning. The plan lays out that the next generation of assessments will be: embedded in learning, adaptive to learners' ability and knowledge, with feedback given in real time, and with enhanced item types that can measure complex competencies. Whether through assessment platforms or data dashboards, such data have the potential to provide more meaningful and timely information to students and teachers about learning progressions. Data will be more diverse, in-depth, and informative for teaching and learning. In combination, the diverse data and the immediacy of feedback will enable more highly adaptive learning experiences made possible by the technology.

Recognizing that the current state of data systems makes interoperability a challenging prospect at best, the plan stresses the need to overcome this issue so that data from multiple sources, including formative and summative assessments, can reside in one repository. The single silo will facilitate easier access for teachers, students, data teams, and administrators. It will enable the triangulation among diverse data sources to obtain more comprehensive pictures of students.

Having the technology infrastructure in place is important, but so is the provision for the human infrastructure; that is, educators must know how to use the data effectively and responsibly (Data Quality Campaign, 2014; Mandinach & Gummer, 2016). They must be data literate. Having students also involved in the examination of data also is a recommendation posed by the Practice Guide on data-driven decision making released by the Institute of Education Sciences (Hamilton et al., 2009).

Methods

This study used a purposive sample of three charter schools, two high schools and one middle school, serving socioeconomically challenged students. The schools were targeted because of their history of infusing diverse technologies into their educational solutions. The schools also have strong building leadership focused on the use of technology and data to support teaching and learning, reflecting the recommendations from the IES practice guide (Hamilton et al., 2009).

The study focused on a core sample of 15 teachers. The study also included building administrators who provided leadership in terms of technology infusion, data use, professional development, and a commitment to enhance teaching and learning.

The study used multiple measures to triangulate data sources. Measures included interviews with teachers and administrators, a survey, multiple classroom observations, an artifact protocol, and a data literacy protocol. Each of these measures focused on the collection of data to address the following:

- What are the technological applications used in the classrooms, schools, and through mobile technologies to enhance teaching and learning?
- What are the affordances of these technologies that provide data to teachers and students to enhance teaching and learning? Are these data unique to the technological applications or are they readily available without the technology?
- What other resources or artifacts do teachers use to enhance their classroom practices?
- What are the supportive resources provided by administrators to make possible the blended learning environments?

Data were collected over a two-year period with several visits to the schools. During that time, the schools experienced some turnover in the teaching staffs, so additional teachers were added to the sample.

Results

Results from the multiple sources of data collection are reported based on the specific method.

Interviews

Interviews were conducted with all participating teachers and administrators from the three schools during the first site visit. As new teachers joined the sample, interviews were conducted with them. A second set of interviews was conducted to discuss progress and changes over the course of the two academic years.

Administrator interviews. The students served by the schools are primarily Hispanic and African-American. Most students come from impoverished homes. Some students are in group or custodial homes. Over 90 percent are on free or reduced lunch. Many students have attendance issues due to long commutes. The students may also lack traditional, supportive home environments where parents or guardians can take an active role in the education process. Because the students face many environmental challenges, the explicit vision for all educators is respect for student needs. Educators hold high expectations for all students and strive to have them attain college. They do this through a nurturing and flexible environment that attempts to customize to the students' evolving needs. Technology plays a major role.

Technology integration is a top priority. The use of technology is seen as a way to deal with relevance because the students have all grown up with technology. They use technology to supplement and enhance instruction, not supplant it. Educators use various technologies to enable students to be connected from anywhere at any time. The technologies are diverse. All classrooms have Smartboards, projectors, COWs (computers on wheels: 30 notebooks), laptops, responders/clickers, graphing calculators, and smart tablets. They use some of the state technology, including connections to data tools and dashboards, to provide a different level of data. They use the Galileo assessment system to provide formative assessments and to engage students in data conversations. Students are expected to accept responsibility for their own learning. Students are also expected to plot their own data and monitor their progress, understanding what they need to do to improve. The philosophy is that data drive the discussions.

The administrators provide many resources for teacher professional development around instruction, curricula, data, and technology. They bring in professional development providers on a regular basis, send teachers to conferences, and provide professional development on Wednesday afternoons, where technology and data use are expected.

The schools have a robust data collection system and process. There is a center server and data system, yet there are still data silos given the diversity of technological applications. The principals are data savvy and constantly working to improve the technology and human capacity of their staffs. There is one central "data guy" that serves all three schools. Diverse data are collected, not just student performance: family contact information, medical (vaccination, special needs), attendance, tardiness, early dismissal, transcripts, missing assignments, grades, languages, family circumstances, growth reports, and other data. There is a FamilyLink for families and students to gain access to the system.

Teacher interviews. The teacher interviews yielded information about four general topics: teacher beliefs around technology and data use; components of blended learning environments; technology; and data use. All of the teachers reported that they believed that using data has the potential to improve instructional practice and help to meet their students' needs. Twelve teachers (80%) mentioned that the use of data helps them to consider what to teach, what to reteach, and allows them to plan their instruction. Thirteen teachers (87%) commented that data drive decisions and their practice must be grounded in data. Data tell the teachers where to go and what gaps need to be addressed. The take-away message was that the teachers could not meet the needs of the students without data and the technologies made possible teacher and student data use.

Every teacher noted that there was an explicit vision for the use of technology. The vision included innovation, meeting the needs of diverse learning through many media, getting technology in the hands of teachers and students to enhance the teaching and learning process, and providing a supportive environment where everything is data driven. The foundational mission is to help all students to live to capacity and succeed.

Teachers were asked how their blended classrooms differ from more traditional ones and what the value-added is from these environments. All of the teachers mentioned that blended learning creates an environment that is more active and engaging for students and requires more hands-on activities. The environment is less formal because it lends itself to more project-based and learner-centered activities. All teachers noted that the blended environment gives students access to a digital world to which they might not otherwise have access. It makes them digital citizens. It therefore has the capacity to level the playing field and provide a door to learning for even the most challenged students.

For teachers, the blended classroom provides significant time savings through the learning technologies, particularly the Galileo assessment system. Galileo provides immediate feedback to teachers and students that would not be possible without the technology, particularly in terms of the drill-down capacity for item analyses. It allows both teachers and students to know where students are in relation to state standards and helps the teachers to formulate and plan instruction.

The blended environment provides a great deal of flexibility in how to provide instruction. There can be individualization with a total customization to each student's needs. There can be small groups or full class instruction. The technologies allow teachers to know where each and all students are in terms of learning goals at all times. Student learning and growth can be monitored at global or fine-grained levels. This flexibility enables teachers to pinpoint students' strengths, weaknesses, and learning needs. The blended environment stimulates better organizational skills and efficiency for both teachers and students through access to diverse data sources that inform the teaching and learning process. Regardless of discipline, the data provided by the technologies enable teachers and students to gauge learning progress through rapid or immediate feedback. The environment promotes the use of diverse data because of the affordances of the technologies that might not be possible in more traditional educational settings. The affordances relate not only to the types of data, but also the feedback loop from which teachers and students are able to access the data. The performance-based data help to guide instruction and allow teachers to know what to reteach.

A component of blended environments is the changing role of the student. These environments place more responsibility on students for their own learning and monitoring their progress through self-examination of data. Essentially, students must become their own data-driven decision makers. Students must self-monitor. They look at their data and monitor their own performance. Because of this, students are more active, engaged, and motivated. They must take more responsibility and ownership for and pride in their own learning. Teachers report that students grow to understand expectations by monitoring their progress. They gain time management skills and collaborative skills.

Technologies are a major component in blended environments, yet they presented some challenges. The multitude of technologies made possible the blending of instruction and learning. WiFi was essential yet somewhat problematic. WiFi was readily available, although bandwidth was insufficient for the demand. Another challenge to having so many technologies is the fact that they often work in isolation with limited interoperability. Indeed, this was the case across the three schools. Applications worked in isolation. Connections were rare and data sharing pretty much nonexistent.

Teachers were asked about their access to data and the sources of data they use. They all reported that they had access to many sources of data. Most of the teachers (93%) focused on the data from the Galileo assessment system, noting that without the system and its analytics, the data process would be impossible and too labor intensive. All teachers were clear that they used much more than assessment and student performance data. Some teachers (33%) mentioned motivational, perception, attendance, behavioral, observational, attitudinal (mood), physical, medical, group processes, background (family), demographic, and coping strategy data. It was clear, though, that the data from Galileo, and the system's ability to drill down to item analyses, loomed large as a data source. Because of the frequent conflation between data literacy and assessment literacy (Mandinach & Gummer, 2016), teachers were asked specifically if data are only about assessments or data are broader. All teachers acknowledged the centrality of assessment data, but also the need to consider the whole child, context, and background.

Yet even with the plethora of data available to them, the teachers acknowledged that there were data they would like to have. Many teachers wanted historical or longitudinal data. They wanted more data on family issues and background (graduation history), arrest records, and background or contextual data to help them gain a more holistic understanding of their students.

Artifact Protocol

The Artifact Protocol was given to all teachers during their initial interview. It asked the teachers to identify the data they use in the course of their practice. Results reflect data from 14 teachers. Teachers reported that they use diverse materials and resources. These include research (10), public media (11), textbooks (9), and diagnostic materials (11). All but one teacher reported using a variety of websites. They consulted websites for their specific disciplines, assessment websites, social media, and professional websites. All respondents reported that they sought help from and consulted colleagues and other professionals. These included administrators, other teachers, the school "data guy," supervisors, former professors, formative assessment professionals, colleagues at conferences, disciplinary specialists, and state data specialists.

Classroom Observations

Classroom observations were conducted for all participating teachers. Some teachers were observed multiple times. The observations noted the classroom setup, forms of technologies in the classroom, media and resources use, type of classroom activities, number, composition, and grouping of students, and structure of the classroom.

Technology loomed large in all classrooms. Every room was outfitted with a SmartBoard, projection system, computers, laptops, and tablets. Other technology applications were used as needed, depending upon the discipline. All classrooms contain high-bandwidth WiFi.

Classrooms in the two high schools were set up around student groups to maximize student interactions. Seating was in pods of students. These classrooms were centered around the use of the SmartBoards. In contrast, the classrooms in the middle school were set up more traditionally, in rows to accommodate the larger number of students. These classrooms also focused on the SmartBoards, but also contained "COWs." Each classroom had a large mobile container on wheels from which teachers would extract laptops or tablets to distribute to the students for personalized work.

Classroom observations yielded rich examples of how different teachers took advantage of the technologies to enhance the teaching and learning process.

- A high school math teacher taught a lesson on seriation. Students sat in small groups with tablets to work on the lesson. The teacher used the SmartBoard where students presented their work and defended their responses to the problem.
- A student approached a high school math teacher with his mobile device. He proudly announced that he had worked through 80 percent of the online assessment remotely. The teacher had set a deadline for completion of the unit and the student remotely worked to meet the personalized time line for mastery of the materials.
- A high school science teacher mixed instructional approaches on a biology topic. She provided selected video clips. She called individual students to her computer to review their progress. During this review, she retrieved each student's electronic portfolio to discuss what they had done well and topics that still needed attention.
- A middle school social studies teacher conducted a lesson on income disparities in Middle Eastern countries. She provided a structured worksheet with questions to facilitate students' online research. The students accessed media from the specific countries to research topics such as average income and gender income disparity. The teacher then asked the class about their findings and the sources of the information, then engaged them in a discussion about income in the countries compared to similar data from Arizona and the United States.
- A high school English teacher worked with her class on an exercise on advertising. Students were grouped together, using tablets, to examine advertisements around which structured questions helped the students conduct their research. The teacher moved among the groups, stimulating discussion about their findings. She then brought the class together for a full-class discussion and presentation of group findings.
- A middle school physical education teacher covered a unit on nutrition and fitness. Students accessed a website that presented the key principles of good nutrition and fitness. Students downloaded an app to calculate their activity relative to the principles. They charted their eating and exercise patterns over time and related this to the key principles.

Observations indicate that the affordances of the technologies were being used creatively and effectively to meet the individual needs of students and to customize instruction in ways to facilitate student learning. That said, there were observations where the classrooms looked no different than more traditional ones. For the most part, however, the teachers used the technologies for planning, instruction, and assessment. Students used the mobile devices for remote learning and assessment, and for activities in the classroom. Teachers were able to monitor student performance and discuss results with the students to keep them on pace. Students were engaged in the performance conversations. Data were readily available to teachers and students that might have been impossible or impractical without the technologies.

Data Literacy Protocol

The Data Literacy Protocol was developed to capture the skills of the data literacy for teachers (DLFT) construct (Gummer & Mandinach, 2015). Given the construct, it was expected that some of these skills would be manifested in classroom practice and observable through classroom observations, whereas others might be exhibited during data-teaming activities, or outside of the classroom. Data were collected for 23 classroom observations, seven of which were repeated measures to determine consistency within a teacher.

The range of observed skills was from 2 (determine unintended consequences) to 23 (monitor student progress). The most readily observable skills were those that affect instructional practice. The most frequently observed skills included individualizing instruction, planning classroom practice, designing classroom practice, and implementing classroom practice (22 teachers). Almost all the teachers showed evidence of articulating a problem of practice (22), monitoring classroom practice shifts (22), using formative and summative assessments (21), adapting current classroom practice based on immediate student feedback (21), incorporating student work as a data source (20), recognizing and using informal classroom information as a source of data (20), adjusting classroom practice (20), and engaging students with their personal results (20).

The least frequent skills were those that are not readily observable in classroom practice. They include: the ethical use of data (3); belief in data (4); comparing data pre- and post-decision (4); probing for causality (4); identifying inaccurate, misleading, or out-of-range data (4); prioritizing data (4); understanding basic statistics such as measures of central tendency and dispersion (5); using statistics (5); reanalyzing the original problem or decision (5); testing hypotheses (5); and considering the need for an iterative decision cycle (5).

Survey Results

Teachers were asked to complete a survey during the first year of data collection. The survey covered several topics related to school culture, technology, data, and leadership. Fifteen teachers completed the survey.

Teachers held favorable views of their colleagues' efforts to support one another and focus on student learning. Respondents agreed that colleagues collaborate (12, 80%) and are focused on the mission of improving student learning (13, 87%). Thirteen respondents agreed that administrators at the school are supportive of teachers, and trust teachers to make decisions about their own instruction.

Teachers identified a number of school conditions that serve as obstacles to their efforts to promote student learning using technology. Nine teachers (60%) believed that students' inadequate technology skills are an obstacle. Six teachers (40%) believed the lack of technical support is an obstacle to student learning. Six teachers (40%) reported there were too few computers and devices to accommodate all students. Eleven respondents (73%) believed that slow WiFi and/or inadequate bandwidth are obstacles. Nine respondents (60%) reported that hardware problems have been obstacles to their efforts to promote student learning.

Accountability loomed large. Eleven respondents (73%) faced pressure as a result of state or district standards and/or testing requirements to cover specific content. This pressure was an obstacle to their efforts to promote personalized learning. Eleven respondents (73%) reported they spend excessive time developing personalized content for students. Seven teachers (47%) said they have inadequate data to personalize instruction.

Absenteeism was a major issue. All teachers reported high levels of absenteeism as an obstacle to their efforts to promote personalized learning. Discipline also was an issue. Twelve teachers (80%) believed that student disciplinary problems present obstacles to personalized learning.

Student performance data are the major data source for teachers, whether in traditional or blended environments. Teachers reported the use of student achievement data to: tailor instructional content and pace to student needs (10); develop recommendations for tutoring and support services (13); identify topics requiring more or less emphasis in their instruction (14); reflect on and discuss teaching and learning with their colleagues (13); and discuss learning with their students (13).

Not all data that teachers used are achievement-oriented. Many other data sources existed. In the 2014-15 school year, five teachers (33%) reported using nonachievement outcomes (e.g., student behavior and attitudes). Of these five teachers (33%), four (27%) used the data to tailor instruction to individual students' needs; three (20%) to tailor the content of instruction to individual students' needs; all five to develop recommendations for tutoring or other support services for particular students; and three (20%) to reflect on and discuss learning with their students.

Teachers had favorable views of their school's data system. Ten teachers (67%) believed they have access to high-quality assessment data that help them adapt the pace or content of instruction. Ten teachers (67%) reported the data system provides real-time data that are actionable. Ten teachers (67%) believed the data system provides information at a level of detail that helps them inform their instruction. Eight teachers (53%) believed they have sufficient data, but need help to translate data into actionable steps.

The survey asked about usage patterns and the sources of data that teachers access. Data closer to the individual student and classroom level (e.g., attendance and personal data) were used more frequently by teachers than other forms of data (e.g., state data).

The role of building leadership in data use is well established (Hamilton et al., 2009). Leadership in the schools confirmed that finding. All 15 teachers reported that administrators encourage data use to support effective teaching. Fourteen teachers (93%) believed the administrators create opportunities for teachers to use data. Twelve teachers (80%) believed the administrators ensured teachers have training for data use. All teachers reported the administrators discussed data with them. Fourteen teachers (93%) stated the administrators created protected time for using data.

Teachers agreed that technologies are useful. All 15 teachers believed they have the proper technology to efficiently examine data. Fourteen teachers (93%) reported the computer systems provide them with access to lots of data. Twelve teachers (80%) believed the computer systems allow them to examine various types of data and 13 (87%) reported the computer systems generate displays and reports that are useful. Generally, teachers reported the available technologies to be useful in their classrooms. Eight teachers (53%) reported the COWs to be useful. Five teachers reported the tablets useful. Twelve teachers (80%) said the Smartboards were useful. Twelve teachers (80%) reported the WiFi to be useful. Ten teachers (67%) reported that mobile devices were useful in the classroom.

Discussion

It is clear from the results that teachers used the richly infused technology and the resulting sources of data to reach their students. This might not be done as effectively without the affordances provided by the technologies. Teachers and students had anytime and anywhere access that allowed them to maximize learning opportunities. Teachers had in-depth item analyses linked to state standards to help them monitor student progress and plan instruction. Teachers reported that the blended environment changes the functioning of the classroom and the role of the student. Teachers also reported that students were more active, engaged, motivated, and involved in their own learning.

All 13 blended components from the RAND work (Pane et al., 2015) were observed in the schools. The schools used *personalized goals* to structure instructional plans for each student. Educators used *student data* to inform instruction and involved students in data-based discussions. Teachers used diverse data and resources to meet the student needs. Data were real time, plentiful, and available. Technologies provided anytime and anywhere access to *outside of school learning* opportunities. The schools provided out-of-school learning opportunities through access to the technological platforms. Teachers *created flexible and multiple paths for students through content* materials by customizing instruction to individual student needs. Students worked at their own pace. They also provided *individualized student support*. Galileo helped teachers ensure that *students progressed through the content based on a competency* model. Galileo also provided *on-demand assessments* through which students were able to demonstrate competency, and provided teachers with real-time data that could immediately inform instructional

planning. Teachers used different *grouping strategies* in flexible ways. Classrooms provided *learning spaces* that supported the technologies and the diversity of learning objectives. Teachers used the affordances of the technologies to provide *flexible learning time* and *extended learning time* beyond the traditional school hours to meet the students' transportation schedules. Teachers stayed late to work with students and provided communication strategies after school hours to meet student needs. *Technology was made available to all students*. In class, each student had a dedicated laptop or tablet. Finally, the two high schools provided students with life skills and *college and career preparedness*. One school's vision included an explicit goal to prepare its students for college. Another school focused on career-ready skills through courses offered by the career and technical education teacher, whose courses emphasized job readiness.

Taking the RAND report's 13 attributes at face value, the schools exhibited the components identified as important to blended learning environments. It is important to note, though, that these schools have characteristics that may not be readily generalizable. First, they were infused with many different technologies and well-trained teachers. Second, one of the technologies (Galileo) provided a rich source of real-time, student performance data that helped teachers make rapid turnaround instructional decisions and modifications. Third, leadership of the schools had explicit visions for student performance, using the technologies and data to undergird all teaching and learning activities as well as administrative decision making. These schools had strong leaders that provided a conducive and open context that promotes collaboration, respect, and trust among the educators. Fourth, the educators recognized the importance of how the blended environments provided flexible and customizable contexts to meet the many challenges of their student populations. The technologies provided the anytime and anywhere extension beyond the brick and mortar of the school buildings. Given the high absenteeism, mobile devices allowed students to use technology in their own time and space. The only limitation was that some students had to seek WiFi hubs because the devices lacked data plans.

In reviewing the school characteristics, it is important to note that the findings are also aligned to the five recommendations of the IES practice guide on data use (Hamilton et al., 2009). The first recommendation pertains to using an ongoing *inquiry cycle* to inform instruction. Clearly, the staff of these schools were identifying problems of practice, collecting data, and making decisions based on those data to inform their practice. The second recommendation is to *involve students in the examination of their own data*. Students in the schools were taking an active role, being their own data-driven decision makers. Teachers worked with them to set expectations and learning goals, and use data to monitor their progress. The third recommendation is to establish a *vision for data use*. As noted above, the administrators explicitly led with data. Their visions were well articulated and modeled. The fourth recommendation is to *create a culture of data use*. This means providing the necessary supports and resources to establish a data culture. The schools created data teams with dedicated meeting times. There was a "data guy" to help the schools with data-related issues. Administrators made possible the time and resources for professional development, technical assistance, and attendance at relevant conferences. Finally, the fifth recommendation is to have a *data system*. The district had a central data system, but also used other siloed applications that served as repositories for data. Similar to the findings in other case studies

(e.g., Bernatek, Cohen, Hanlon, & Wilka, 2012a, 2012b, 2012c), the data systems lacked interoperability and data sharing capacity, leaving each system to function in isolation. This is a major issue due to the proliferation of diverse sources of data.

Other challenges existed such as data sharing, interoperability, and the plethora of and accessibility to data that were generated through blended learning. With the proliferation of data from diverse sources come concerns about the protection of data privacy. The collection and examination of these data sources, particularly in real time, provide great opportunities for the customization of teaching and learning. Yet, even greater challenges exist in terms of maintaining the safety and security of the data to protect students' privacy and confidentiality (Data Quality Campaign, 2016; Herold, 2014) and ensure that the educators are knowledgeable about how to use data not just effectively, but responsibly (Mandinach & Gummer, 2016). Data privacy has become a key issue and continues to be a concern.

Blended learning certainly has taken hold in these three schools. These are charter schools serving a relatively small number of students. The question of the model's generalizability is of concern. More traditional schools are not likely to have the similar resources. They may have less technology. They may lack a vision for the use of technology and data. They may not have an embedded data culture and technology that extends within and beyond the school boundaries. They may not be provided with the extensive learning opportunities found in these schools in terms of professional development, technical assistance, and conference attendance. That said, there is much that can be learned from these three schools about how the alignment of RAND's 13 attributes (Pane et al., 2015) and the IES practice guide's five recommendations (Hamilton et al., 2009) in school settings can create blended learning environments that have the potential to reach even the most challenged students and help them to succeed.

Acknowledgments

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Inclusive Teaching With Digital Technology: Supporting Literacy Learning in Play-Based Kindergartens

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Abstract

Young children who are English Language Learners or have special learning needs can find it difficult to communicate in kindergarten classrooms. Open-ended tablet applications offer multi-modal tools for these children to communicate their ideas, engage with others, and demonstrate and develop their knowledge and skills. They position students as the producers and creators of the literacy content. Using pedagogical strategies such as effective routines, opportunities to collaborate and share with peers, and modelling, kindergarten educators can employ open-ended iPad apps to support the literacy and digital learning of children who are English Language Learners or who have special learning needs.

Background

Young children who are English language learners (ELLs) or who have special learning needs (SLNs) can have a difficult time communicating their knowledge and skills in typical early learning classrooms. They can be constrained by tools and practices that privilege able-bodied children who speak the language of instruction and who are strong in formal academic skills. Typically, early years educators assess children through observation, paper-and-pencil tasks, or oral questioning. For children who are ELLs, or who have SLNs, these types of assessments can fail to reveal an accurate picture of the range and depth of their interests and abilities. Educators and peers may view these children in stereotypical ways due to a focus on traditional academic tools and skills. This can, in turn, negatively affect the children's self-image and may lead to social isolation in the classroom. Open-ended iPad apps can offer alternative visual and auditory tools for children who are ELLs or have SLNs to communicate their ideas, engage with others, and demonstrate and develop their knowledge and skills.

This paper reports on the first two years (2015/2016-2016/2017) of a three-year a research study examining the use of open-ended iPad apps to support young children's literacy learning in 14 full-day kindergarten classrooms in Ontario (ages three to six). Literacy in this study is defined broadly, as meaning-making in multiple forms including visual, oral, print, and digital. Literacy activities are often social and collaborative in nature, and are integrated into play and other content areas such as Mathematics and Science. The curriculum for kindergarten in Ontario, *The Kindergarten Program* (Ontario Ministry of Education, 2016), advocates a play-based approach to learning and teaching:

> Play is a vehicle for learning and rests at the core of innovation and creativity. It provides opportunities for learning in a context in which children are at their most receptive. Play and academic learning are not distinct categories for young children, and learning and doing are also inextricably linked for them. It has long been acknowledged that there is a strong link between play and learning for young children. (Ontario Ministry of Education, 2016, p. 18)

The classrooms in the study are situated in two large urban school boards in Ontario. The children come from families that are culturally, linguistically, and economically diverse. Children enter the kindergarten program in the year that they turn four, and stay for two years. The iPad apps used in this study, *30 Hands* and *Explain Everything*, are open-ended. They offer a range of visual recording options including drawing, photo, and video functions, as well as audio recording. There is no content other than a few background scenes, and they are not designed to teach any specific skills. These open-ended apps complement a play-based approach to learning and teaching. All children, including those who are ELLs or who have SLNs, were able to explore and document their learning in ways that met their individual learning needs through the multimodal tools provided in the iPad apps. The research question that governed this study was: How do children who are English Language Learners or who have Special Learning Needs explore, document, and share their thinking with open-ended iPad apps in a play-based kindergarten?

Literature Review

Several recent studies describe how mobile digital technology (DT), such as smartphones and tablet computers, are being used to support young children's literacy learning at home and at school, and to create a school-to-home link (Neumann, 2016; Radesky, Schumacher, & Zuckerman, 2015; Wong, 2015; Blagojevic, Brumer, Chevalier, O'Clair, & Thomes, 2012). While some studies have examined the use of e-Books, e-games, digital drawing pens (Lee, Wu, & Chen, 2017), augmented reality toys (Yilmaz, 2016) and learn-to-read apps, studies that report on the use of open-ended iPad apps in school environments are emerging (e.g., Fleer, 2014; Herro, 2015). In fact, several studies (e.g., Rowsell & Harwood, 2015; Falloon & Khoo, 2014) illustrate the dynamism with which DT is being explored in early learning classrooms as a way to redefine literacy acquisition, expression, development, and consolidation.

The use of iPads and open-ended apps expands the range of modes that young children have available as they make meaning. Rather than just drawing and writing, they have access to photography, video, audio, clip art, and so forth, which they can use in isolation or in combination (Rowsell, 2017). This multimodal approach to literacy helps to reveal children's interests, motivations, and different pathways to literacy (Kress, 1997). As Gee (2005) reminds us, new technology allows for thinking and making meaning differently, "learning in a new domain… requires the learner to take on a new identity" (p. 34). Through open-ended mobile apps, young children can interweave the many physical and digital texts in their lives to represent what is meaningful to them (Burnett, Merchant, Pahl, & Rowsell, 2014). Young children need time and space to engage with the multiplicity of literacy texts that they encounter. Play is a necessary part of this (MacKey, 2011). Through play, children can experience the thoughts, feelings, and behaviours that ground different identities, informed by the texts they have experienced.

Open-ended mobile tablet apps can offer one way to engage in, document, and reflect on meaning-making play activities.

The multimodal affordances of open-ended iPad apps are particularly effective in supporting the literacy learning of children who have special learning needs (SLNs) or who are English Language Learners (ELLs). Two recent studies highlight the positive effects of multimodal DT for children with Autism Spectrum Disorder (ASD). Flores and colleagues (2012) found that using iPad apps with children who had ASD and limited verbal interaction increased the amount of their communication and made communication faster and easier. Moreover, both the students and their teachers reported enjoying the iPads more than traditional communication methods for children with ASD such as the Picture Exchange Communication System (PECS). Oakley, Howitt, Garwood, and Durack (2013) found that children with ASD increased both their engagement and the level of their literacy achievement when using DT to create multimodal texts.

Children who are ELLs have a better chance of performing well academically when their home languages are valued within the classroom, and when they are offered a culturally responsive curriculum and pedagogy to meet their needs (UNESCO, 2011). Rodriguez (2010) suggests children's home languages can be supported by educators in early years programs with attention to a few specific strategies, including being informed about the benefits of using and maintaining home languages, encouraging the use of the home language at home, and providing learning materials that reflect the diverse home languages of the children in the program. In fact, when children are given the opportunity to use their home language in addition to learning the majority language, they show cognitive advantages in terms of cross-cultural understanding and communication, problem solving, comprehension and verbal flexibility (Nicoladis, Charbonnier, & Popescu, 2016). Open-ended iPad apps can provide support for children to consolidate and enhance their home language while continuing to develop their proficiency in the language of instruction.

There are voices urging caution when using DT with young children (e.g., NAEYC, 2012; Radesky et al., 2015; Council on Communication and Media, 2016), yet these same researchers also champion the potential of DT for children's learning when it is used in ways that are active and interactive, and support an inquiry stance to learning. When used intentionally, new digital literacies can help educators teach students to question, construct theories, and develop the skills needed for active global citizenship (Wimmer, Skramstad, & Khan, 2012). The increasing complexity of how we communicate as a global society means that we need highly skilled teachers who have a broad definition of literacy, can incorporate digital technologies (DT) into their learning programs, and recognize that literacy is rapidly evolving. However, current pre-service and in-service professional learning offer little guidance on the appropriate use of DT in early years programs.

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Methodology

This paper reports on the first two years (2015/2016-2016/2017) of a three-year study of 14 kindergarten classrooms in Ontario as they used open-ended tablet apps (*30 Hands* and *Explain Everything*) in their play-based programs. The tablet apps were used most often during open-ended activity time, but also during outdoor play and more focused literacy activities. Most classrooms had two educators (27 educators in year 1 in total, and 25 educators in year 2 in total). The educators, Registered Early Childhood Educators (RECEs) and Ontario Certified Teachers (OCTs), were all interviewed before the study began to determine their experiences with DT and their attitudes towards using DT with young children. At the end of year one, they were interviewed again to see if their attitudes towards using DT with young children had changed, and to learn about what they perceived to be the challenges and benefits of using the tablet apps in their programs to support literacy learning. At the beginning of year two, they completed a questionnaire on similar topics, and at the end of year two they were interviewed again. All educators attended a focus group each year. The interviews were recorded and transcribed, and detailed notes were taken during the focus groups. Classrooms were observed biweekly using participant observation. Research team members also worked with small groups of children during these biweekly visits to support them in their use of the apps. Students had individual accounts within the iPad apps where they could archive their slideshows. Samples of student digital slideshows were collected and analyzed. All children's names are pseudonyms.

Findings

Support for English Language Learners

English language learners (ELLs) and children with special learning needs (SLNs) often need extra support to communicate their thinking in educational settings. For ELLs in this study, open-ended tablet apps supported them in three ways: 1) they allowed children to practice their English skills and consolidate their skills in their first language; 2) they enabled children to communicate their ideas and showcase their skills; and 3) they provided opportunities for children to become integrated into the classroom community.

ELLs in several classrooms in our study practiced their English skills using the open-ended apps on the iPads. They would take an iPad and record themselves speaking English in a quiet corner of the class. They would listen back to their recordings, often erasing them and rerecording their voice. Both the ability to practice in private and to erase and rerecord seemed to be important and motivating factors. The iPad apps provided a safe opportunity to take the risks necessary to become proficient in a new language. The children were not singled out for language practice, as other children were also using iPads for many purposes around the room. They were able to choose what they wanted to say, get immediate, private feedback through listening to their recording, and were able to assess their own progress. This provided a more natural and less stressful opportunity to practice their skills in a new language than being asked to speak in front of others or to complete specific language exercises.

The following slideshow was made by Omar, an ELL, who created a tower out of magnetic geometric tiles. He used the iPad app *30 Hands* to independently photograph his tower and then audio-record his description of his creation and of the process. He is clearly proud of both the finished product and the fact that the created it on his own. In his recording, the sounds of a busy classroom can be heard as well as his explanation, "This is a picture of a big tower. I do it by myself with no help."

https://drive.google.com/open?id=0B-UwQzpzAxH2TVJZcWJGSUpJYXBlUzdQNDBrTFJQcnRURjFR

Because Omar was able to practice and then rerecord what he wanted to say in a private space in the classroom, he was able to complete an accurate and expressive account of his building activity. When his teacher found the slideshow on the iPad later, she was surprised and pleased by the level of sophistication of his English and his positive attitude towards his work.

In addition to providing opportunities to practice and enhance their English skills, several educators reported that ELLs used the iPad apps to consolidate their use of their home languages. Children created slideshows in their home language, either on their own or with peers who spoke the same language. This allowed them to enhance their home language and strengthen a home-school connection, which is vital for multilingual children. Aisha, for example, created a flower with classroom materials, asked a research team member to hold it while she photographed it with the iPad, then recorded herself singing in her language. She called it her language song:

Fig. 1: Aisha's flower

https://drive.google.com/open?id=0B-8zbVoc9owiLW05NDdlZk1JRUU

She effortlessly recorded her voice in both English and her home language using classroom materials as a prop, and then proudly played the slideshow for her mother at the end of the day. The iPad app also allowed another student, Fatima, to create a link between her home language and English, and between the classroom environment and her family.

For other children, the iPad apps provided an opportunity to speak with others who shared their home language as well as practice English with other ELLs. At the end of the first year of the study, one educator remarked that two Mandarin-speaking children with limited English realized that it was acceptable to speak in their own language as well as to continue to learn English. When they first used an iPad in the class, the children took it to a quiet corner and videotaped each other saying a few short phrases in Mandarin. Later they photographed their block structures and audio-recorded longer passages in Mandarin. The educator described the children's reaction and the positive consequences:

> The two little guys would get talking in their first language on [*30 Hands*], they thought that was quite interesting. They were amazed when they could see what happens. They played it back and they thought it was quite funny. You know, but it was not just laughter, it was more about communication in Chinese because prior to that they were talking in English and didn't know they could speak Chinese in class. So I think that once they realized they could, they seemed to flourish. Their English has also developed as a result of it so that was nice too. (Kindergarten Educator, Spring 2016)

These two children initially believed they could only speak in their limited English, and were therefore constrained in their ability to communicate in class. Through the use of the iPad apps, they realized that they could communicate in their first language to other Mandarin-speaking students. They went from being shy and quiet students to being animated and more fully involved in activities around the classroom. This, in turn, led to the development of their oral English skills.

The second way that the open-ended iPad apps supported ELLS was by giving them the ability to effectively communicate their knowledge and skills to their educators and peers in spite of their limited proficiency in English. The open-ended apps allowed the children to use drawing, photography, and video in addition to text or audio to communicate their ideas. Several educators reported finding slideshows made by ELLs on the iPads that contained evidence of interests and digital skills that had been previously unknown to the educators. For example, one educator reported that when she was checking the iPads, she found Javeen's slideshow containing several drawings of a vacation he had taken with this family, including audio recordings with simple descriptions of the drawings. The educator had not known he had taken this vacation, or that he had the digital or storytelling skills to independently create a slideshow. The slideshow provided the opportunity to learn more about the child's abilities and his activities outside of school. This knowledge provided the foundation for a meaningful discussion, an important part of learning a new language. It also enabled the educator to build on this new knowledge in her planning, and to showcase and celebrate Javeen's accomplishments with the rest of the class.

Children who were ELLs were also able to share their interests and skills with their peers using the iPad apps. In some of the kindergarten classrooms, sharing digital slideshows of documented work became a regular part of classroom group time. Children would build with blocks or other materials, paint pictures, or draw or write on paper and then photograph their work on the iPad apps and audio-record a description. Some also created drawings on the iPad and narrated fictional stories using the iPad apps. They would then show the digital documentation they had made at group time, and either explain what they were showing or play the audio of their previously recorded explanation. This would be followed

by questions from educators and peers. Several ELLs, who were too shy to speak at group time generally, were confident enough to share their documented work on the iPad. When they were asked questions about their work, many were not able to give long explanations of their iPad creations, but could answer "yes" or "no" to their peers' questions. In this way, the iPad apps allowed them to participate in the classroom routine of sharing from which their limited English has excluded them. As one educator explained, having the time to reflect on their learning, gather their thoughts, and rerecord if needed, enabled them to overcome the "performance anxiety" inherent in sharing in front of a group. She explained:

> Just seeing some of the kids that wouldn't normally explain their thinking so well, they were really stopping to think now after they did something, "What did I do?" So it was a chance for them to start to really talk about it. And even if they were too shy to maybe explain it or they couldn't get their thoughts together in a class setting, they could use the iPad and talk about what they did. And we figured out how to even re-record so they knew that if what they were saying wasn't working out they could try again. The ones who didn't have much English they could still say little things that were helpful in explaining their thinking…And it built their confidence for sure. So I think that helped with the language and the confidence building. (Kindergarten educator, June 2017)

The third way that the open-ended iPad apps supported ELLs was by functioning as an integration tool in the classroom. When children do not speak the language of instruction, they can become isolated in a classroom setting. In this study, the iPads functioned as a medium of introduction and integration for ELLs. Several of the ELLs were already proficient in the use of iPad apps when they joined their class, or they quickly became proficient. This skill attracted other children to them. For example, in the second year of the study, one educator told the story of a new child in the class, Bentley, who was not a native English speaker and who had rarely spoken in class. Bentley watched other children on the iPad and quickly became one of the most adept children in the class. The other children wanted to be close to him to see what he could show them. He was a patient and effective teacher and soon was engaged in iPad collaborative projects with other children. This increased Bentley's social status in the classroom and he was sought out by other children at other times of the day. The iPad apps allowed him to use his digital skills to share ideas, mentor his peers, collaborate, and socialize even though he did not share a common language with the other children in the class. For the ELLs in this study, the iPad apps supported them in their academic and social integration into the kindergarten classrooms.

Support for Children With Diverse Learning Needs

Within the 14 classrooms in the study, there were several children who had special learning needs that ranged from mild learning challenges or delays to significant cognitive and/or physical challenges. There were three main ways that the use of the open-ended iPad apps supported the learning of these children: 1) the open-ended nature of the apps meant that there were multiple entry levels for communication from simple to sophisticated; 2) the multiple modes available on the iPad apps (e.g., visual, audio, text) allowed children to communicate using their strengths and supported them in their areas of challenge; and 3) the iPads supported the integration of children with special learning needs into the classroom.

The open-ended apps used in this study, *30 Hands* and *Explain Everything*, can be used to create very simple drawings or photos or more complex multimodal creations. Children were able to use the apps at their individual ability levels and could progress at their own pace. Children in the study who faced learning challenges were able to communicate their ideas in ways that helped them to overcome the barriers they faced with traditional paper-and-pencil tasks. For example, children could take a simple photo of the room, themselves, a classmate, or a creation they had made. The photo below was taken with an iPad by the artist, a four-year-old student. She was able to independently and effectively document her artistic creation as a digital slide without recourse to speaking, reading, or writing.

Fig. 2: Photo taken with iPad

Children could also choose a blank slide and use the drawing tools to experiment with lines and colours, or they could draw a scene such as the one below. This child has drawn a scene with a rainbow over a field of grass with an oversized, smiling insect. It certainly communicates a story with emotion and energy, but without the use of audio or text.

Fig. 3: Rainbow with smiling insect

Children who were more technically skilled could use a combination of tools to create a slideshow like the one below. For this slideshow, the child chose the desert background, drew a scene from the movie *Star Wars*, and then audio-recorded himself humming a song from the movie. As in the previous examples, this quite sophisticated digital slideshow did not require advanced traditional academic skills in order to communicate a strong message, but the child clearly displays sophisticated digital skills.

Fig. 4: Scene from *Star Wars*

https://drive.google.com/drive/folders/0B-GF9ZCaXHvLc1VHb3lwY25Xb1E

Children who were at an early stage of formal school literacy accomplishment or who had a learning challenge were able to use the tools in the open-ended apps at a level that matched their needs and abilities.

The second way that the apps supported children with special learning needs was through the multiple modes that were available on the iPads. The apps provided tools that allowed the children to remove barriers that they faced and allowed them to express their ideas more powerfully. Children who had a range of challenges were able to express their ideas using the multiple modes within the apps. Those who had challenges with fine motor control, and therefore found it difficult to draw or write, could audio-record their ideas. Children who had difficulty speaking or encoding their ideas in text could communicate visually through photos, videos, and/or drawings.

For example, for Connor, a child with autism spectrum disorder, the iPad app modes of drawing and audio-recording supported him in his areas of challenge and gave him a positive voice in the classroom. Before he used the iPad apps, Connor spoke very little and had minimal social interactions with other children. He was often perceived as having disruptive and challenging behaviour in the classroom, and he was reluctant to try new things. Using the iPad app *30 Hands,* he communicated his ideas through drawing on blank slides and recording simple stories, which he proudly shared with others. The open-ended iPad app allowed him to overcome his fear of failure through the ability to record his drawing and his voice in private and delete and redo his work if he was unhappy with it. After using the iPad apps, he began to be seen in a different light by his educators and peers. Rather than a virtually nonverbal, disruptive student, he began to be seen as a creative student who had a positive voice in the classroom. One of his classroom educators describes her observations of Connor:

> With Connor, I noticed that it gave him the self-confidence, it gave him the ability to have a voice and to be able to be creative and problem solve in his way….although he has autism, one of the things I realized with him was that he was so afraid to do something, he was afraid of failure…[with the app] he can just delete and start over again. It was his ability to tell stories. So when he has drawn a picture he'll add the words to it and you can see his face, he's beaming because now he has a voice. He has something that he can actually show us, show his ability to move forward. (Kindergarten educator, June 2017)

The open-ended iPad app supported his areas of challenge, including speaking on the spot and communicating his ideas clearly. It allowed him to share his ideas in a creative and productive way, and to have a positive voice in the classroom.

As the previous examples have shown, the open-ended iPad apps served as tools for integrating children with SLNs into the rest of the class in a similar way as they did for ELLs. This was the third way that the iPad apps supported children with a range of special learning needs. For example, Eric, a child with a learning and speech delay, used the open-ended iPad apps to document his interest in trains and to draw other children to him. With the support of a member of the research team, he took the photo below of a train he had made out of magnetic tiles. He then traced over the photo using a drawing tool:
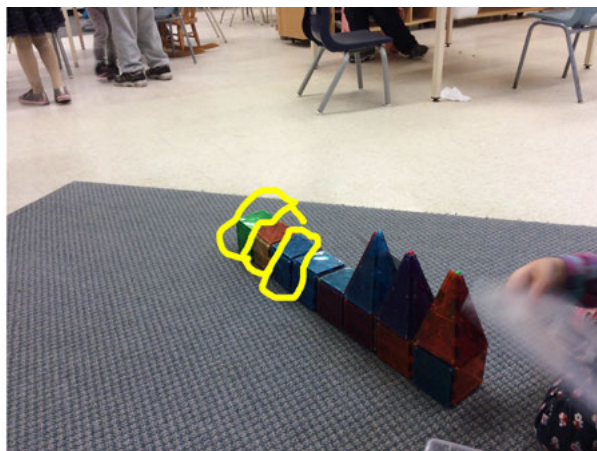

Fig. 5: Train made from magnetic tiles

The research team member then began to videotape Eric in "selfie" mode so that he could watch the video as he continued to build his train. She then played the video back to him and he stopped building and smiled, pointing to his creation in the video and saying "train!" Another child came over as he was building and they worked together taking turns building and recording each other. Previous to this, Eric has been building trains alone and had not attracted the attention of other children. However, the act of building, then documenting and viewing his work on the iPad, drew another child into the play episode with him.

Barrier or Bridge?

At first, some of the educators in the kindergarten classrooms worried that the iPads were creating a barrier between the children who were ELLs or had SLNs and the rest of the classroom. They worried when they saw these children off on their own with an iPad. But over time, they began to see that the open-ended iPad apps were providing children with a bridge to full integration in the classroom. The iPad apps contained the tools and autonomy they needed to think through and practice what they wanted to express, in ways that worked for them. The children then either presented their products to their educators and peers or simply archived their work on the iPad. This was not only true of these two groups of children, but also for children who were shy. As one educator explained,

> I think [the iPad app project] has been really effective. There are a lot of quiet kids that we have in the class that wouldn't always come and tell you and be enthusiastic about what they've done. And then you realize that they've made a six-minute long recording about something they've made - and with excitement. And all these words that you are like, 'Oh okay, so you do talk about your stuff a lot'. But sometimes I guess maybe being by themselves with the iPad they are a little more confident than talking in front of everybody else as a whole group. (Kindergarten educator, June 2017)

Pedagogical Strategies

When the kindergarten educators first began to use the open-ended iPad apps in their classrooms, they experienced a number of challenges ranging from technical (e.g., learning to use the iPad and apps), to structural (e.g., WIFI issues, shortage of electrical outlets and secure storage), and pedagogical (e.g., when and how to incorporate the iPad apps into the program). Over the first six to eight weeks, they developed a variety of strategies to manage these challenges, including pedagogical strategies to support the kindergarten students in their use of the open-ended iPad apps. The pedagogical strategies applied to all children in the classrooms, but were particularly important for ELLs and children with SLNs. As mentioned earlier, the kindergarten program in Ontario is play-based and focused on inquiry learning. All of the classrooms had large blocks of time during which the children could choose from a number of activities in the classroom. Some popular activities were building with large or small blocks, dramatic play, and art activities. The iPads were most often used during these play periods. Early in the first year of the study, the educators established routines for the students' use of the iPads. For example, the educators wrote a third of the children's names on each of the three classroom iPads and left them out on a table or low counter for the children to access. The children knew which iPad contained their archived slideshows and they were able to access them independently. Children could either work alone or collaboratively with peers to document their work and their thinking in any way they chose.

Strategies for extending thinking and descriptive language. The kindergarten educators encouraged the children to document their work on the iPads visually, through photos or drawings, and then to audio-record descriptions and explanations of their work. Initially, many children created drawings or took photographs of their work without including audio recordings. Later, they added simple descriptions. With practice, guidance, and modeling, they began to give more detailed descriptions of their creations

and began to discuss the process of their creation. As one educator explained at the end of the second year of the study:

> I think a lot of them just learned how to explain their thinking. Because at the beginning of the year it was a lot of "my brain told me" or "I did it because I wanted to". Whereas now, if they show a picture or a video they say, "I used a square here" or "The tower kept falling down but I fixed it". A lot more detail comes out of it when they share that picture on the iPad than when they write about it or when we are just standing around it talking. (Kindergarten educator, June 2017)

The educators helped the students to achieve this more sophisticated level of description and analysis through informally interviewing the children about their work and suggesting that they audio-record their answers. Another educator explained how this worked in her classroom:

> If I see someone next to me recording, I will ask questions and that will extend what they are recording about. Instead of them just saying, "I made a train", I will go further and ask them, "What kinds of shapes do you see in your train?" and, "How many blocks did you use?" (Kindergarten educator, June 2017)

Over time, the children began to take on the role of interviewer that was modeled by the educators. They began to ask each other to expand on their descriptions, as one educator explained, "We are giving the responsibility to the kids. So one of the kids will take [the iPad] and they will interview the child who has made that creation like we had modelled it" (Kindergarten educator, June 2017). Another educator remarked on how some of even the youngest children became proficient interviewers:

> There was one [four-year old] student who was a very confident speaker. He would ask another student, "What made you think of this idea?" or "Can you describe that?", "I can't hear you. Can you talk louder?" So things like that. I said, "Jason, you've been listening to what we've been asking you." (Kindergarten educator, June 2017)

Strategies to support peer learning, teaching, and sharing. Another effective pedagogical strategy used in the kindergarten classes was the encouragement of collaborative learning and peer teaching. In the first year of the study, all of the children, both the four-year olds and the five-year olds, were learning about the iPad apps at the same time. However, some had experience with iPads at home and therefore quickly became independent users. Others had a particular interest and aptitude for the iPads and this led to early proficiency. The educators were quick to encourage the more adept students to teach their peers how to use the apps and to work collaboratively with peers on projects of joint interest. By the second year of the study, the five-year olds (senior kindergarten or SK) had a year of work on the apps under their belts and were able to introduce the four-year olds (junior kindergarten or JK) to the apps. This not only cut down on the educators' workload, but it also proved to be more effective. As one educator explains below, learning from a peer was seen to be more "authentic":

> And they've become very independent. Because when they work in groups sometimes, the SKs take the leadership to teach the JKs what they can do – instead of us. And I think getting that information from their peers is way more authentic then when they get it from us. So it is neat to see how they are interacting with that device. (Kindergarten educator, June 2017)

As mentioned earlier, some children were eager to show their digital creations to the educators and the whole class, while other children were more reluctant to share their work. The latter case was particularly true for many children who were ELL or had SLNs. In order to accommodate both the confident children and the reluctant children, many educators began having an iPad sharing time as part of their whole-group activities. The children could sign up for the day that they wished to share their work. This helped the children who were eager to share by assuring them that a time had been set aside for them. For the more reluctant children, the list encouraged them to prepare a digital slideshow ahead of time. Many of these children were pleased to be involved in sharing time and were confident to share the slides that they had prepared when they were given advanced warning and time to prepare. For some children, this prerecorded digital sharing led to a greater willingness to share in "real time," unmediated by the iPad.

Discussion

Fears that digital technology (DT) use may lead young children to become sedentary, passive, and unsociable are common in some of the literature on the subject (e.g., NAEYC, 2012; Radesky et al., 2015; Council on Communication and Media, 2016). These same research studies and many others, however, also mention the potential for DT to enhance children's learning and development. In this study, the fears about DT and young children were not realized, but the potential for enhanced learning opportunities was. The use of open-ended iPad apps in 14 play-based kindergartens led to active and interactive use by the kindergarten children. The iPads provided the children with tools to collaborate with peers, document their inquiries, and deepen and extend their communication. The tools provided by the iPads and the apps *30 Hands* and *Explain Everything* were particularly effective in supporting the needs of English Language Learners (ELLs) and children with special learning needs (SLNs).

In keeping with recent research investigating iPad apps for young children in educational settings (e.g., Falloon & Khoo, 2014; Fleer, 2014; Herro, 2015; Rowsell & Harwood, 2015), the findings of this study illustrate that iPad apps can support literacy learning for young children. The expanded modes available on the iPad (photo, video, audio, text, etc.) were motivating for children and supported them as they explored and documented their interests, as suggested by Rowsell (2017). The children in this study exhibited a wide range of oral literacy skills including planning, describing, analyzing, explaining, co-ordinating, presenting, teaching, storytelling, and singing. Their visual literacy skills were no less wide ranging and included taking photos and videos of themselves and others, of the indoor and outdoor environments, and of their own creations. They also drew on blank slides using a variety of drawing tools and made use of the background scenes in the apps. Moreover, they often embellished the backgrounds and their photos by drawing over them. They incorporated text into their slideshows in the form of letters drawn by hand or through the use of the keyboard. The children often combined two or more of these literacy skills in their documentation, demonstrating considerable digital skills. The open-ended nature of the apps used in the study

allowed for children at different levels of English language proficiency and different levels of literacy learning to effectively engage in meaning making using a variety of literacy skills.

For children with SLNs, use of the iPad apps increased the ease and amount of their communication, as Flores et al. (2012) found in their study. Moreover, they were more engaged with learning and created more complex literacy output as described by Oakley et al. (2013). The multiple modes available in the iPad apps allowed children in this study to use the mode that best suited their abilities (visual, auditory, text, etc.) and to overcome barriers that traditional literacy tools and approaches such as paper and pencil or face-to-face spontaneous conversation may have caused. Children who were ELL used the iPad apps to communicate in their home languages, an important literacy practice (Rodriguez, 2010), as well as to practice their English language skills.

For both ELLs and children with SLNs, the open-ended iPad apps provided them with the ability to privately practice their communication, and to erase and redo it if desired. This allowed them to build the skills and confidence they needed to share their work with their educators and peers. It also led to a greater integration of these children with the rest of the class. Students at different levels of English proficiency and with different levels of literary accomplishment were able to collaborate using the iPad apps. Students learned about each other's interests and abilities through the use of the apps, and were able to make use of this information to collaboratively construct digital documentation of their thinking.

For the kindergarten educators, the open-ended iPad apps provided a vehicle to learn about the interests and abilities of children who were ELLs or who had SLNs. For those students who were not yet proficient in English or in the use of traditional learning tools, the apps provided other ways for the educators to acquire the information they needed to support their continued learning. The apps also proved to be effective tools for drawing out shy or reluctant learners, as well as for helping other children to focus and extend their thinking. In addition to providing support for literacy learning and development, the educators found the apps supported them to integrate collaboration, creativity, and digital learning into their programs.

Conclusion

The findings from this study strongly suggest that open-ended iPad apps, when used in a play-based program, can support the literacy learning of all children, but can be particularly effective for children who are ELL and who have SLNs. The success of the iPad apps in supporting literacy in these kindergarten programs may be due to a number of factors. It is important to note that the iPad apps were not used to teach specific literacy skills, or to act as behaviour management tools (i.e., to calm children down or as a reward), but as a way to support children to document their work and their world. The children were encouraged to follow their interests, express their creativity, and to work collaboratively, and they were given large blocks of time to do so.

The educators supported the children's use of the iPad apps through a number of pedagogical strategies that were neither overly structured, nor were they completely hands-off. They sought to expand and

deepen their students' thinking and communication through providing effective routines, thoughtful questions, and meaningful opportunities to collaborate and share their work with peers. The educators, in turn, were supported by the research team as they learned how to use the iPads and apps, and how to integrate them into their programs. The educators repeatedly expressed how essential this ongoing support was as they developed the technical and pedagogical strategies they needed to effectively employ the apps in their classrooms. It appears that it was the combination of these factors that led to the active, engaged, creative, and collaborative literacy experiences that occurred in the classrooms in this study.

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Journeys to Teaching Qualitative Research Methods Online

Kathryn Roulston, Kathleen deMarrais, and Trena M. Paulus

Abstract

Teaching in online spaces requires new roles and competencies. Presented as autoethnographic narratives, three faculty members describe their journeys into online graduate instruction in qualitative research methods. Areas of growth included effective course design and planning and strategies for building community. Challenges included keeping up with the technology and finding adequate resources. These narratives provide potential issues for consideration by faculty new to online instruction.

Background

While the potential of online modes of delivery such as Massive Open Online Courses (MOOCs) to provide "education for all" and revolutionize higher education presaged by educational technology entrepreneurs such as Daphne Koller and Sebastian Thrun (cofounders of Coursera and Udacity, respectively) have yet to occur (Rohs & Ganz, 2015), a different revolution is underway. Numerous online portals are attracting students for professional development purposes (Corcoran, 2016) as well as recreation and leisure pursuits (Warner, 2014). In higher education, the attraction of online instruction is reflected in the numbers of students taking online coursework. Fourteen percent (2.8 million) of university students took all coursework at a distance in the fall of 2014 (Allen, Seaman, Poulin, & Straut, 2016, p. 10). At the same time, 67% of higher education students in the U.S. enrolled in "at least one" distance course do so at public institutions (p. 12). Yet, public institutions lag in enrollments when compared to private for-profit institutions, with only 27% of students taking at least one distance course, as compared to 60% at private for-profits. Even while increasing numbers of students are taking online courses, some faculty continue to be unconvinced of its merits. Allen et al. (2016) commented that: "A continuing failure of online education has been the inability to convince its most important audience – higher education faculty members – of its worth" (p. 26).

While an increasing number of faculty members are teaching online at public institutions, little is known about their experiences, since research has tended to focus on faculty working at online institutions (Yick, Patrick, & Costin, 2005) or part-time for distance institutions (Dolan, 2011; Ng, 2006)—which, in the US, continue to be the main purveyors of online coursework. Researchers have reported on their transition to online teaching in mathematics education (Fernández, 2014), occupational therapy (Farber, 2013) and nursing (Myers, Mixer, Wyatt, Paulus, & Lee, 2011). A small number of articles provide descriptive accounts of the online delivery of coursework on qualitative research methods. Bender and Hill (2016) described the strategies used to teach undergraduate coursework in qualitative research methods online; Kaczynski and Kelly (2004) discuss the integration of Qualitative Data Analysis (QDA) software (NVivo) in an online three-course sequence on qualitative research methods; Maggio, Chenail,

and Todd (2001) provide accounts of their integration of technology-mediated learning strategies in teaching coursework on family of origin, qualitative research methods, and family therapy respectively; Moore and Janzen (2012) present a dialogue between and instructor and student concerning the online delivery of a coursework on qualitative inquiry in the field of health; and Ryen (2009) describes the planning and implementation of online delivery of qualitative research methods coursework in a master's program in Development Management. What all of these accounts have in common is that they provide descriptive accounts of the planning and implementation of teaching qualitative research online.

This paper focuses on the transitional journeys into online teaching described by instructors of qualitative inquiry. Five in-depth qualitative interviews were conducted by a graduate assistant.[1] Two interviews were conducted with the first and second authors and one with the third author for a total duration of five and one-half hours. Narratives were reduced to key ideas (Kim, 2016) relevant to understanding individual transitions and arranged as autoethnographic tales (Chang, 2008; Marx, Housen, & Tapu, 2016). We organize these tales by first introducing the context of our work, our first experiences with online teaching, our approaches to course design, how we manage the weekly teaching schedule, the importance of building community, and reflections both on what challenges us and what we enjoy.

The Teaching Context

Around 2010, the first and second authors began to explore alternative models of delivery to the weekly three-hour face-to-face meetings that were typically used. In part, this was to provide access to students who were not in Athens, Georgia. At the time, our college did not provide a great deal of support for online instruction. We began by experimenting with hybrid delivery prior to offering a fully online version of the Interdisciplinary Qualitative Studies certificate program in 2014. By then, the institution had begun to support faculty teaching online by establishing an Office of Online Learning. We also searched for and hired an additional faculty member with extensive expertise in online instruction (Trena). These are our stories …

Where We Began

It's 1986, and I'm at home in Bethel, Alaska, which is 400 miles due west of Anchorage, not far from the Bering Sea. I've called into a central audio conferencing site, and I'm about to talk to my students, who come from all over: Barrow, Fairbanks, Bethel, Nome, and Dillingham. I'm just about to learn what the weather is like where they are. This is my first experience with distance education, and it isn't the same as face-to-face. I really get to know the students and it's fun. I'm comfortable with it. (Kathleen)

It's the late 1990s, and I'm a doctoral student at the University of Queensland, Australia, listening to feminist scholar, Dale Spender. She is forecasting the future of higher education in the age of the Worldwide Web. Spender tells of a time when students will have access to instructors at other institutions anywhere in the world via online coursework. Students will choose their instructors! I think of the obstacles: the cost of technology, the technical skills required, and so on. I reject Spender's prescience altogether. (Kathy)

It's 2000, and I'm a doctoral student in Bloomington, Indiana and have recently started teaching a Master's course for a completely online university. I have no real idea what I am doing yet, and I quickly learn that interacting with adult students who are working full time (most of whom are likely much older than me) only through asynchronous forums and e-mail is fraught with danger. Being from the Midwest, I focus only on the tasks at hand with no real thought to relationship building or getting to know the students personally, so when students constantly turn assignments in late and don't post to the discussion forums I am mystified. Frustration levels rise all around and I vow never to do this again.

It's now 2017, and each of us feels comfortable teaching our content area—qualitative research methods —in online environments that make use of a variety of asynchronous and synchronous tools. Our work as teachers is informed by the principles of qualitative pedagogy—a term coined by deMarrais in the late 1990s and outlined by Preissle and deMarrais (2011, 2015) as an approach that

> assumes that the *principles* guiding the *practices* of qualitative research should guide instruction in qualitative research, and it represents an overall approach to teaching qualitative research to novices and others new to qualitative traditions. Our position is that we ought to teach our research practices in ways faithful to how we practice research and scholarship. The qualitative pedagogy we advocate is responsive, reflexive, recursive, reflective, and contextual. (Preissle & deMarrais, 2011, p. 32) (Italics in original)

It is in the spirit of this qualitative pedagogy we have approached sharing our learning about our own teaching in this paper. Here are our stories…

Kathy. When our program first talked about offering online coursework, we met with a representative from the Center for Teaching and Learning who recommended blended delivery[2] (Garrison & Vaughan, 2008) as a way to transition from face-to-face to completely online teaching. Beginning in 2011, I sought student feedback as to what worked in online contexts through a series of teacher research studies (Hubbard & Power, 2003) in which I examined what went on in my courses. I also took online classes in different formats. By 2014 I had taught several hybrid classes, engaged in research of my practice, taken a variety of online classes, participated in professional development opportunities at my university, and completed the Certificate in Online Teaching offered by the Online Consortium (formerly Sloan Consortium). While I do not have a degree in instructional technology per se, I had been involved in several technology projects as a K-12 teacher and had worked in an ACOT school.[3] Although I like to try new things, it was still challenging to upgrade my skills and learn to use different tools.

Kathleen. I'm an early adopter and like figuring things out. I started using hybrid delivery formats before I tried teaching fully online. When I was first introduced to computers in the 1980s, I used to react to technology—"I hate it! I'm not ever doing it." Now I don't. I'm much more patient with myself. I've taken workshops, and spent time learning new tools like ScreenFlow. If I can't work it out myself, I am able to get help just in the nick of time. "OK, here's a problem. Can somebody help me with this?" Fortunately, there are usually resources available. Each time I teach a course, my goal is to learn one new thing. We really worked together a lot on the development of the courses. What we are trying to do is to have

the same look and feel across the certificate program. And we have had really good support from the Office of Online Learning.

Trena. The first online class I taught was a master's course in instructional design in 1999 for an online university. It used asynchronous discussion and email. Then I helped put the master's program in instructional design online in the department where I was doing my doctoral degree. It was still asynchronous and text-based with a few short videos or podcasts. For my dissertation research, I studied how small groups work together online to complete tasks. When I became an assistant professor, I didn't teach online for a long time because the revolution hadn't hit that university yet. When it did, the goal of the program was to increase enrollment so we did away with our on-campus program and went completely online. We intentionally used a synchronous and asynchronous model because my colleague and I really felt like that model was the best of both worlds, based on our own experiences and research in the field.

Institutional resources for supporting faculty in online teaching vary quite a bit from place to place, which can be a challenge. I'm glad that there was phenomenal support for faculty at my previous institution when it comes to teaching and technology. I got a lot out of that. I try to get just-in-time help, like when I was ready to do a Camtasia video I asked someone to come over and show me. I'm comfortable with the technology. It doesn't intimidate me or make me nervous. I think it's easier for me to take it up maybe than for other faculty.

Not everyone who is interested in teaching online is an early adopter or a tech-wizard, so there is need for support and professional development when transitioning to online teaching. Faculty members have different learning preferences also. Some benefit from learning experientially by being online learners; others will make use of just-in-time support and instruction in how to use new technologies; and those whose research encompasses the Scholarship of Teaching and Learning (SoTL) will enhance their teaching practice through conducting research on their own teaching. However professional development is undertaken, teachers transitioning to online contexts do need to develop expertise in planning and designing online instruction and making effective use of new technologies. These professional development opportunities will be more robust when supported by findings from current research that discuss the expanded roles of online instructors that involve responsibilities for curriculum development, course design, and course administration and facilitation. Thus, there is need for professional development opportunities to be tailored to be responsive, reflexive, recursive, reflective, and contextual with respect to the needs and learning preferences of faculty.

Course Design, Preparation, and Planning

Kathleen. We decide together as a program on the learning outcomes and gear assignments and the discussion posts to those. I look at the assignments, and I figure out how I am going to structure each weekly post to meet the outcomes of the course. What we found worked is that students apply what they have learned from the readings in their weekly writing activities. We work towards application: create this, or develop that, with the assignments building towards the final paper. I have a system where I model what I am teaching; we read about it, we do guided practice, then independent practice. Evaluation follows in an action research cycle. We teach qualitative research the way we do qualitative research (Preissle & deMarrais, 2011, 2015).

Trena. I want to support my colleagues, but it's also been tough because program design decisions were made before I arrived. I believe in synchronous interaction but that was not the norm. I've had to reconcile what I have experienced with the institutional realities. I have personal beliefs about what works, but also have to work with people who've had different experiences that are also valid. So, we try to make the best decisions for the program.

I design the courses week by week. I map out the course schedule first and start early to find out what nights people are free for the synchronous sessions. I often have guest speakers so I invite them early on to get those dates on the calendar. Once the syllabus and the schedule are complete, I set up the platform with the different modules. I typically open the whole course so students can see it all at once, although usually I'm developing it one step ahead of them the first time it's offered. I do introductory videos that are more relational than content delivery. They reflect back on what happened the previous week, remind students of things that have come up and answer questions. As the course moves along, I tailor discussion questions to address issues that have come up.

Kathy. There's a lot of preparation. Kathleen and I settled on a weekly module to structure each course. Each module contains three folders—an introductory folder with a checklist, a content folder with an audio presentation or screencast and links to other materials, and an activities folder. For good learning to occur online, the technology should not be a hindrance. However, you organize the course needs to be easy and available on multiple platforms. Students don't want to click too many times because they'll get lost, very quickly. Yet the technologies continually change. When the learning management system (LMS) was updated, my audio presentations[4] no longer worked, so I had to buy new software and convert all of the presentations. So I spend a lot of time on course development and updating materials.

Kathleen. I want materials that I can refer students to in multiple classes, so I set up all modules ahead of time. The first time I did a fully online course, I tried to make sure that each module was up a week ahead of time. It was really hard to do that... But now I feel really comfortable with the course. I spend a lot of time on the first module so the course gets off to a good start. I make sure that I do not add dates or refer to specific students in course content because I want to use material again. I made that mistake early on—I was trying to really relate to the students by incorporating them into presentations. But you can't use them again. So, I've gotten smarter.

Teaching online, like learning online, involves time (Spector, 2005)—but creating and sharing plans, approaches, and resources across the program as a team helps. There are many best practices that can help ensure that a course "works," and we've tried to collaboratively create practices specific to our program. Although course preparation and planning entails extensive time, once a course is developed, aside from continuous revisions, the structure and content is reusable, thus enabling a robust course in future semesters with less preparation.

Managing the Weekly Schedule

Kathleen. I prepare a schedule that details what we will do each week, with the learning outcomes, the readings, the materials, and then the activities. I walk students through this and have them rely on the schedule. I have a forum in which I can answer general questions and one for technology issues where they can help each other in case I'm not online. I make sure that there is an introduction to each module, a list of learning objectives, and a checklist of what they have to do. For example, "Read the assignment steps, here's the chapter, view the case study PowerPoint, complete Writing Exercise 1.1, review the video." We have found that it's useful to have a structure that the students become familiar with. They know what's coming and the course runs smoothly.

Kathy. I structure each week in the same way because it is helpful for people who are working full-time and have families, to know that they need to post on the same day each week. That's helpful for the majority, although a few would rather have variation. I generally don't answer emails on the weekends —if it's urgent, I'll just send students a note. I read all students' posts and write a group response or make a screencast. The more I post in the threads, the less students are going to respond to one another, so I try to keep that to a minimum. If I see misunderstandings going on, I will intervene and try to help. I use rubrics to grade, and I make those explicit to the students. What I try to do is go into the grading system and write my comments on students' responses after their initial post. Then once students have finished their discussion for the week I'll post grades with comments for everyone. So, you know, "Great job" or "You need to do this" or whatever. Some people do need a prod. I will email and say, "You know, I haven't heard from you this week, what's going on?"

Trena. At the beginning of each week I post an opening video. That's when the class should start looking at materials. Then, students make their initial posts to the discussions as written or video responses. I read through all the discussion posts and if there are questions that I'm probably the only one that can answer or something really interesting, I will post a response, and use that information to plan the week's synchronous session. If they attend the synchronous session, students don't have to participate in discussions for the rest of the week. If they don't, they need to watch and post a reflection on the recorded synchronous session. I don't do long synthesis posts, though they're probably really helpful to remember the highlights. Instead I summarize the previous week as part of my opening video for the next week, in that way providing continuity across the modules.

In the weeks that assignments are due, students are not doing new readings and discussions because that is not manageable. I try to get assignments returned within a week. I think that's really important online. I give individual feedback on participation about one third of the way through the course. I don't require students to make a minimum number of posts because if you do that, they will post exactly that many. So I tell them how many posts they've made relative to other students in the class and what kind of grade that will earn them. The LMS records how much time students spend reading and how many posts they've read, so I remind them that I can see that too.

While the structure throughout the semester is predictable, we strive to design challenging qualitative assignments and provide discussion prompts to keep students' interest levels high and to support their research skills as they move toward dissertations. While we each have a different approach to how we facilitate each course and manage the weekly schedule, we share goals. These include systematically designing courses that are clearly organized and easy to navigate, providing timely feedback, and encouraging interaction among students with the intent that learners engage in a meaningful array of authentic activities that develop knowledge and expertise in the conduct of qualitative research.

Building Community With Students Online

Kathy. While building community is invaluable, I'm not entirely sure what you have to do to foster that. Students have to be willing to engage with one another in authentic ways. I think you have to build in peer review and ways for students to ask genuine questions of one another. Whether a course sparks into a community that outlives the course is uncertain, but I know that it has happened.

People take an online course because they want to do it anywhere, anytime. I use synchronous meetings to let students know what's coming up, provide opportunities to ask questions, and talk about topics that have come up in the discussions. I typically give a short presentation, and I try to allocate time for students to talk to one another in small groups. Meetings are recorded for those who can't attend.

As an instructor, you have to share, too. I try to be supportive of students—to recognize they are working hard. I'll send jokes, little pictures and use apps like Tellegami or Voki, not so much for the content, but for fun. It's not all about the content. We need to recognize that we're all people who are working hard and we can help one another.

Trena. Teaching online requires something different than lecturing. I don't see discussions as a place for students to display their knowledge as much as a chance to interact and read what other people's ideas are. I ask students to be sure everybody has a response. If they are not attending the synchronous session, they need to contribute to the asynchronous forums. Online courses used to have attrition rates of 50% or more because there was no interaction or engagement. The chat function in the synchronous meetings adds one more layer of interaction. While I am doing my mini-lecture or while the guest speaker is talking, students can ask questions via chat. It's great for that, I really like it a lot.

The hardest thing about teaching online is that it is really easy to jump to conclusions and assume the worst. Students can be dehumanized really quickly when you're only interacting with them through email. This is why I like students to see me on video; this is why I like having synchronous sessions. It humanizes us and builds community. Reaching the students who are not as active as you think they should be, but who might be doing as much as they are able to, is a challenge. Not everybody wants to be overachievers in online classes, so figuring out the right amount of reaching out can be tricky.

Kathleen. If you never see the students in person, the challenge is to build that relationship. I have to get my personality on that screen and get to know theirs. I have found that the students really want to see your face. I try to make screencasts more personal. If my cat comes and sits with me, I'll say something about the cat, or I'll do it at home where they can see my workspace. I have a video at my house with my chickens!

I'll politely point students back to the resources when asked questions, because you have to continually build this relationship. I say, "Oh, you probably overlooked that. Now, look here, look there, or look here." For synchronous interaction, I have optional "coffee hours" where students come in and we talk about their questions. I keep it to an hour and record it if they can't come.

If students take an online course because they didn't feel like driving down two blocks to get to the face-to-face class and thought it was going to be easier, it doesn't work. The instructor has to figure out why the students took the class in the first place and then try to reach them wherever they are. I started out with "personalized instruction" in 1971. I think that the online instruction is really very much like that. You have to put the structure in place and the design; then you have to personalize it for each student. We treat people as individuals and take them from where they are.

Previously high attrition rates for online programs have been reduced since educators and researchers realized the importance of building a community to keep students engaged. We use a variety of strategies for this, including using a range of asynchronous and synchronous tools that facilitate interaction among students and the instructor. The Community of Inquiry model (Garrison, Anderson, & Archer, 2000, 2001; Garrison & Vaughan, 2008) that advocates for a balance between teaching, cognitive and social presence has been helpful in understanding what is needed to promote the development of a healthy online community in our classes. Still, students are motivated to take online courses for a variety of reasons, including convenience. Deciding on the best means to develop an effective online community is something of a challenge for instructors, given the range of options available. This can be accomplished through the use of synchronous meetings where the instructor and students are visible to one another via video, or through regular interaction in the forums. Creating personal connections and working relationships among students helps. This can be facilitated through peer-review activities and through thoughtful and well-designed group activities.

Challenges of Teaching Online

Kathleen. It's hard to create time for course development a semester ahead. As Department Head, I was able to embed one of the designers from the Office of Online Learning in our department for 20 hours a week … that was the best help. Trying to balance research, administration, and teaching is really hard. Sometimes there's been a $5,000 stipend for the summer to develop a course…. you can do some with that, but it's not going to cover much time.

Kathy. I can't produce the absolutely gorgeous things you might see in some courses. I've felt frustrated over the years because to do fantastic online education you probably need a production team. If a YouTube video isn't interesting in the first three seconds, you are probably going to go to something else and I fear that will happen in my course. The challenge for me is to give something value added to understanding this content which might not be that visually appealing.

Trena. I don't find the LMS[5] at the university exciting and I find myself wanting to "like" people's posts all the time. In *Discourse*[6] that feature allowed you to signal "I've read this" without having to write out a reply. You can't do that in our LMS, but I know that's just social media culture influencing how we think about interacting. Tagging would be nice, too, if there was a post in the LMS I'd like to be able to say, "Maybe John can help," but there's no way to tag John and that's really handy with the *Discourse* site. You can bring somebody into the conversation by tagging them like you can on Facebook. I just feel like the LMS will catch up eventually.

Advocating for online courses to be recognized as having integrity and high quality is really important to me. There is still a stigma attached to it. People enroll thinking it means independent study and I've had students say, "Oh I'm just going to catch up later." I'm like, "You can't catch up, this isn't independent study. If you weren't here posting all week, you weren't here." We're fighting an uphill battle where students, administrators, and faculty all still believe that the only reason to take an online class is because it's convenient. This is why I think the synchronous component is important. Students have to be willing to dedicate at least a few hours of the week to the class. It can be place independent, but I don't think it can be both time and place independent for 15 weeks and be as successful as when you are making that commitment to sacrifice a certain period of time to be present with other people in real time.

There are many reasons for teaching and learning online and many models of online delivery and learning. Yet, online learning still suffers from stigmas in the larger community. We are continually challenged to design and deliver courses that meet our goals, are within our technological grasp, and convey the integrity of our courses to others.

Kathleen. I feel bad if I don't get students' papers back to them really quickly. I feel guilty: "Oh my God! I haven't been on, I have to go check. I hope everybody's OK." I don't want to have them left out there alone. So, trying to keep up with it and trying to respond in a timely manner when everything else has to be dealt with is tough. If something has come up to delay my responses, I try to communicate that to students and encourage them to do the same. Good communication with students and between students is key for keeping the course running smoothly.

Kathy. As an instructor, I don't have the skills to fix some of the technical problems that I've encountered in using synchronous tools and used to get really angry. But some of these are out of the control of the instructor and a software engineer is needed to fix them. I'm aware that students, particularly if they're new to the online class, have high levels of anxiety. The technology is always going to change. Things aren't going to work the way you expect them to, so if you can't handle that kind of thing, you probably shouldn't be doing this. Now I let students know the plan: if this happens, this is what you need to do. We have to work through this together.

Trena. There is a huge reliance on the technology that makes this all possible. Knowing that when the grid goes down, it's all over, is a scary feeling. That's why the technology glitches that we face make us so frustrated: because we rely so much on good Internet connection, computers that work, electricity…When my Internet connection went down while teaching from home it made me realize how precarious everything is. Just like with backpacking, if a bear comes and eats you, there's nothing you can do. Or one misstep and you have a sprained ankle out in the wilderness—you're done for! So it's all great until one thing happens and you're like "Oh!" When our Internet went down I thought to myself that if this happens again, I can't do this because I can't have things not working while students are in class.

The immediacy of technological problems and responding to online students' needs and anxieties challenges instructors in ways that quickly engage the emotions, particularly negative emotions (Bennett, 2014). Without a high level of support and technological expertise, this work is difficult. While our online courses appear well put together after years of development, the faculty emotions of getting to that point, as well as the time required, are not so evident to those who have not engaged in this work.

What We Like About Teaching Online

Trena. I'm glad I teach online. I really like being able to bring in speakers from other places. In one class, there were people gathering from all over the world. I like that you get diverse perspectives. The whole reason distance education began was to give people opportunities that they wouldn't otherwise have. I get energized and excited after my synchronous sessions. Maybe it's just the miracle of it, that I can be sitting in my home office, interacting with all of my students in a way that I feel is really meaningful and that I think they've enjoyed—having a chance to talk about what we've been discussing in the forums. I find it really rewarding when we've had a successful synchronous session. I also like the visibility of it, the neatness and orderliness—it's like backpacking (my new favorite metaphor for online teaching). The whole class is right there and you can access it at any time, and yet there's also dynamic, interactive discussions going on. And you're not tied to a particular place, just like with backpacking, you put everything in your backpack and you go someplace else and you set it all up again.

Kathy. You get to know your students in a different way than you would otherwise. Because everything's in writing, I learn otherwise unknowable things about students that they share. As far as the academic outcomes, I can learn much faster who is doing what and what kind of misunderstandings they might

have or who has expertise in areas that I might never imagine. There's equity in talk time; everyone's voice becomes public whereas in a face-to-face course, people who are very introverted or might be speaking English as a second language may choose to remain silent in a course and you never really get to know them. They can't do that in an online course.

Online coursework is more accessible and more convenient for commuter students. It's friendlier to adults who have families, who work full-time. I think that's a good thing. In graduate education, universities have really catered to full-time students who are privileged to get assistantships. Online courses seem much more like a collaboration. We have wonderful students who know so many things that we don't. And students share their knowledge. So I hope that somehow in the course, students will recognize the power of the personal learning network.[7] In the future, people will be able to package their learning in many ways: face-to-face, independent online learning, and online interactions with others. I've come to a much greater appreciation of how we can help one another learn in online environments.

Kathleen. I really feel very pleased when things go well, when I can see student learning and questions. There's something about online teaching that I find very intriguing. Maybe it's the challenge of it—I'm going to do this really cool course and try these new technologies. When you teach face-to-face, there are always the students who want to be quiet in class. So, it's a challenge to attend to them and also to the extroverts who have to talk through what they're thinking about. And it doesn't leave space for the students who are sitting quietly. In an online class I get to know everybody. Even introverts have to put their work out there in writing. What they put out there is a reflection of what they are thinking and one would hope it would be their best work. And, if it's not, I can do something to correct that, and to provide better expectations for them or to say, "Hey, this isn't good enough. Sorry. Try a little harder next time!" So, I *love* my online students and teaching online even though it's much harder. It gives me more freedom in my work schedule. So, I don't have to be here Monday nights for three hours. I can work from home. If I weren't an administrator, I could spend my work hours more productively without wasting time commuting.

Conclusion

Even with the challenges of learning the technologies and spending the time needed for course development and instruction, we support online teaching and learning. As faculty members who value our freedom to work where we want when we want, pushing ourselves to learn to teach high-quality courses has been rewarding. We recognize that online teaching and learning is not for everyone—faculty or students. We appreciate the immense variety in how online educational programs might be delivered. With new technologies constantly being created, the possible ways to deliver quality online education will continue to grow.

We are not advocating a particular "best" approach to online instruction, but share our stories to illustrate the ways in which we as teachers have approached our own learning of new technologies and ways of working within hybrid and fully online environments. Through our individual and collective stories here,

we illustrate our individual processes over time and ways we have come together as a faculty to support each other's learning and development as instructors. Our stories offer possibilities for approaching online teaching through qualitative pedagogy. As a concrete example of this approach to instruction, we might think of our pedagogy as a research design where we first examine the context of the study as well as our research purposes and goals. Our students are our participants as we take into consideration the context in which they come to the course and build and reflect on our relationships with them throughout the course. As researchers/teachers, we are sensitive to what is going on in the environment through continual reflection and reflexivity in order to make changes along the way and to work with the individual needs of the students as well as those of the instructor. Our pedagogy, like our research, leads to further growth, and more stories.

<div align="center">****</div>

> *This growth might be thought of as a vast river of ideas.*
> *Or maybe it's a tsunami.*
> *Or a backpacking journey.*
> *What should a teacher in the early part of the 21st Century do with the constant flow of new information, tools, and technologies?*
> *We offer these stories to others who want to explore*[8]

Notes

1. We thank our graduate assistants for their contributions, including Elizabeth Pope for conducting the interviews, and Erika Cooper for transcribing them.

2. There are many models for "blended" delivery and terminology used is not consistent across institutions. At our institution, "blended" delivery is used to refer to programs offered in ways that incorporate face-to-face and online delivery, and "hybrid" delivery is used to refer to coursework that incorporates face-to-face and online delivery.

3. Apple Classroom of Tomorrow.

4. Developed in Articulate Presenter.

5. The Learning Management System used at the institution is supported by Brightspace (formerly Desire2Learn).

6. Discourse is an online course management application available at discourse.org.

7. Rheingold (2012) provides ideas for how people can thrive online using social media to build a "personal learning network" that is generative and supportive.

8. This closing poem is generated from interview data and conversations among us.

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Pedagogical Implications for Using a Wiki
in Peer-to-Peer Learning Environments

Lisa Russell

Abstract

The pedagogical potentials and challenges experienced when trying to incorporate the use of a wiki social media site with undergraduate childhood study students are reported. The wiki was introduced to inspire students to engage in student peer-learning, develop their writing skills, and facilitate a PhD student's developmental teaching beyond the dissertation phase from PhD student to scholar. Although these aims were achieved to a degree, they were reached in unexpected ways. A "community of practice" (Lave & Wenger, 1991) was evident within the actual seminar session space rather than within an online community capacity.

Background

There is an emergent demand to design learning experiences in Higher Education (HE) that develop collaborative and mediated social practices (Page & Reynolds, 2015). There is recognition that students are entering HE with a different skill set and are engaging with lectures and seminars in changed ways (Cole, 2009). Alongside this shift there is a movement towards more student-centred learning (Jonassen, Peck, & Wilson, 1999). HE educators are increasingly looking towards more participatory, reflective teaching practices, which has generated a growing interest in the use of web-based technology to create more flexible, interactive learning environments. Working collaboratively has shown to improve learners' ability to understand and retain information (Johnson & Johnson, 1986). Participatory learning among peers has evidenced improved student engagement (Cole, 2009), enhanced writing capabilities (Page & Reynolds, 2015), and developed pedagogic learning amongst new lecturers within a university teaching context (Warhurst, 2006). It is against this backdrop that the use of the wiki as an innovative teaching tool has emerged. This paper examines the pedagogic learning of 25 Undergraduate Childhood Study students and one Sociology of Education PhD student's new co-teaching lecturing experiences related to constructing and maintaining the related wiki site. The lens of situated learning theory (Lave & Wenger, 1991) is used to gain insight into the ways in which the degree of full or periphery participation within the wiki online and physical seminar "community of practice" space enhanced learner understanding and writing capabilities if managed in a mediated and (re)negotiated way.

Wiki Context

A wiki is a

> hypertextual system for storage and transmission of information. Every page on a wiki is created and editable through the web using a web browser. The vision of wikis is an evolution from plain hypertextual systems for learning and information retrieval. Wikis facilitate the connection between community and content. The success of Wikipedia is the most prominent example of the potential of the wiki concept. (Ravid, Kalman, & Rafaeli, 2008, p. 1915)

Wikis are usually discussed from two perspectives, as a software tool used to achieve social learning goals and as a social practice through which mediated social contexts are created and collaborative learning is experienced by a collective (Page & Reynolds, 2015). The use of wiki practices fosters a collaborative, egalitarian learning that facilitates group interaction and challenges traditional student-teacher modes of learning (Ruth & Houghton, 2009). Pages are co-created by members to form a collective network structure ripe for communal editing, shared knowledge, and constructing understanding, so that data and writing are co-produced and continually renegotiated, amended, and developed. This differs from the traditional mode of a single person digital design or a one-way mode of communication cognizant with email (Mindel & Verma, 2006) or from document-sharing services which act as a collective data storage space with independent document editing capabilities such as Dropbox or Google Drive (Page & Reynolds, 2015). From a social practice perspective, a wiki is viewed as a social practice within and through which learning emerges from member interactions co-created within the social and learning context. The learning experience is negotiated via the group, rather than on an individual basis, making within-group and virtual team working possible. Wikis have been viewed as a revolutionary educator tool that enhance peer group learning and undergraduate writing capabilities, as well as helping new university lecturers develop their pedagogic practice and lecturer identity.

Situated Learning in Communities of Practice

Situated learning theory offers a radical critique to cognitivist theories of learning that accentuate the individualistic assumptions of learning as a discrete and decontextualized activity, founded on a positivist assessment of abstract knowledge. Rather, the relational aspects of learning and the social construction of knowledge is emphasized within a context of community of practice. Learning is thought as emerging through membership in a community and not as primarily abstract. The wiki can be viewed as a community of practice, as a virtual space whereby learning and identity are co-constructed for the undergraduates, the PhD student and indeed the lecturer, but also the physical space of the seminar gathering is important. Levels of participation can be analyzed and all degrees are accepted as valid with the peripheral participator moving towards full participation as time goes on. Situated learning theory positions the community of practice as the context in which an individual develops the practices (including values, norms, and relationships) and identities appropriate to that community (Handley, Sturdy, Fincham, & Clark, 2006). This differs from theories of socialization (e.g., Vygotsky, 1978) which assume a natural reproduction of values, norms, and identities over time. Within situated learning theory, individuals bring their own personal history and norms to the group, which may or may

not comply with one another in the community context. Such differences need to be (re)negotiated and reconciled if the individual is to achieve a feeling of belonging to the community. This means that there needs to be an understanding of the individual's and the groups situated learning within and beyond the community (Handley et al., 2006), but also an acceptance that the learners enter the community or wiki space with a set of personal characteristics and values that can be safely discussed and (re)negotiated within the seminar group pedagogical practices. Whilst peer-group learning has been analyzed within this theoretical context in relation to the use of wikis, the postgraduate learners' identity formation and pedagogic development beyond that of the doctorate have been given less consideration. The use of the wiki here is analyzed in terms of group and individual use, both within the physical space of the seminar room and beyond to include that of the virtual space.

Using and Analyzing the Pedagogic Value of the Wiki

The wiki was created and used with one seminar group across several sessions from October 2015 to April 2016. This one group was selected as a pilot in preparation for the use of the wiki the following academic year. The rationale behind this was twofold; firstly, to inspire students to engage in student peer-learning and start writing in an academic undergraduate format—a problem that has long since been identified as a challenge for this year's group on this particular module, and secondly to integrate and develop a PhD student's developmental teaching beyond the dissertation phase to help her make the transition from PhD student to scholar. My PhD student participated with online discussions and was encouraged to add relevant material and assist with the general set-up and ongoing maintenance and monitoring of the wiki. She and I also did some co-teaching on the module.

For the purpose of the experimental teaching session, the wiki was stored, administered, and accessed through "unilearn"—the University's virtual learning environment that provides access to electronic documents, social media tools, and assignment submission tools to support students' studies. IT support was thus readily accessible and students could access all seminar work in one place.

At the start of the module and academic term, the first-year childhood study undergraduates were introduced to the notion of a wiki via a group discussion led by the lecturer and use of the YouTube link uploaded by Common Craft (2007), "Wikis in Plain English." Together, a home page was developed to include the YouTube link and a "Wiki do's and wiki don'ts" page that resulted from the seminar discussion between the students and the lecturer. The students were aware that this was a pilot and that the lecturer was also new to using wikis. The list comprised the following:

Wiki do's and don'ts page

Wiki Do's

HAVE A GO!
Post relevant information related to the module (these can include book chapters, journal articles, YouTube clips, images, or newspaper articles).
Be respectful in your tone but do voice your opinion.

Wiki Don'ts

Avoid malicious comments and arguments.
Cite original sources for assignments.

An ideas page was established to encourage the undergraduates and the PhD student to add relevant images, website links, newspaper articles, books and journal references. During the initial stages, there were technical issues setting up the site and getting access for all students. Students needed reminding about how to access the wiki and what its purpose was. After the first month, it became apparent that both the undergraduates and postgraduate required clear direction from me in terms of what resources to input, types of activities to engage with, and set tasks to complete. Consequently, activities were set and executed in session to actively engage the students and develop a community of practice. With encouragement, students started to insert photographs of their seminar group work and some extra resources were entered. Both undergraduates and the PhD student seemed reluctant to voice their own opinions and write independently and confidently on the wiki, so I instigated group discussions around set topics and asked students to form group-written answers to relevant questions. Fostering a mutual community of practice took time and constant direction. Although some students used the wiki, most of this was done in seminar under lecturer direction, rather than taking on a life of its own. I had to do more than simply build it.

Findings are taken from two 20-minute focus group interviews with the seminar undergraduates and one 15-minute semi-structured interview with the PhD student (in February 2016) to explore their experiences of contributing to the wiki and their learning processes and outcomes. All interviews were transcribed and hand-coded. All data was triangulated alongside the document analysis of the actual wiki site content; frequency of use of wiki resources within assessments and my weekly wiki diary to analyze the use and content of the wiki, the student's contribution and level of participation with the wiki inside and outside of the seminar space (inside space is defined as the physical space of the seminar room and actual time of scheduled seminar, as opposed to outside space, which includes anything beyond this) and how use of it may be improved.

From PhD Student to Scholar

Part of the rationale for setting up the wiki was to aid my PhD student's academic career trajectory after (the near) completion of the PhD. The doctor of philosophy (PhD) degree is intended to prepare students to conduct original scholarly research for the thesis and beyond (Fleming-May & Yuro, 2009). Postdoctoral training is vital to a successful career for education-based researchers to help them gain substantive knowledge and expand their research repertoire. Evidence suggests that PhD students experience difficulty navigating this transition and require further support (Downs & Morrison, 2011). HE institutions and PhD supervisors can assist this transition for those who wish to make the shift via supporting students beyond the doctorate with their writing (for publication and grant awards) and teaching. It is within this ethos and the mutual support offered by the PhD student and the lecturer in terms of maintaining and actively contributing to the wiki that the postgraduate student (PG) was invited

to take part and inject a new voice and fresh material to the wiki site. While use of the wiki helped the PhD student and added to her teaching repertoire, this participation alone was not sufficient to fully support her desired academic-based career trajectory.

LR: Is there anything that you've learnt through doing those seminars or doing some developmental work on the wiki?

PG: Yeah. One of the things that I've picked up is about how to engage less forthcoming students particularly the first-year students, I learnt how to kind of re-engage them with material at a later date and that's been particularly useful for me. It's been useful to see how a seminar is run in a university as opposed to a college.

LR: Did it help in terms of your confidence or thinking about what you might do next in your career?

PG: I think it's given me a bit more confidence, I wasn't entirely sure about how the teaching that I'm involved with at the moment would be different in a university setting and when I was an undergraduate student I was at a red brick university in a huge cohort so it was very different to how things are run here so, in terms of confidence, it's made me realise that there are differences but there are also quite a lot of similarities in terms of the actual teaching, so if I was able to come and teach at a university I wouldn't have too many problems with adjusting.

Adding another voice to the wiki was useful in helping the wiki content develop and retain self-sustainability. It enabled the PhD student to experience a different way of teaching in a distinctive environment and boosted her confidence and knowledge regarding using different technologies within her own teaching practice in a FE setting and may possibly help her gain a paid academic position in HE.

LR: Have you used any social media in your teaching?

PG: We have Moodle which is our Virtual Learning Environment and there is a discussion forum on that and I've tried to encourage them to upload their own resources particularly when they are in their dissertation year and so I've encouraged them to do that. It's been a really useful experience for me just to see how it's organised and the types of students that you get. I don't have a lot of experience in teaching eighteen year olds and I think that has been really valuable for me, because it is very different and it can be really hard to get them to engage, so it's been useful for me to watch how you do those sorts of things so, moving forward, I've got a bit more experience of working with students like that.

This reveals the multidimensional nature of teaching and the opportunity educators have to embrace the undergraduate and postgraduate experiences in a peer-group forum enabling everyone to participate in some optimizing way.

A Wiki Way of Writing for the Undergraduate Student

Most of the students found the wiki site of some use. It took a few months to get the wiki fully functioning. There was a familiarization process whereby students became acquainted with university procedures and policies, in addition to familiarizing themselves with the wiki. Most used it as a safe forum in which to explore ideas and as a resource rich with student, lecturer, and PhD student-led content. Undergraduate students (US) used it in different ways and during different times, illustrating the benefit of this flexible, interactive pedagogical approach.

> LR: Did you understand the wiki?
>
> US: Yes.
>
> LR: What did you understand was its purpose?
>
> US: To share ideas on it and to look back on what we've done.
>
> LR: And do you think you've used it in that way?
>
> US: Yeah, because it's gained us an understanding of other people's perspectives on their topic.
>
> LR: Have you found it useful?
>
> US: Yeah.

Some used the wiki as data storage and retrieval site, a place where they could refer back to previous seminar discussion content and useful references. Yet, most didn't see it as a direct means of improving their academic writing, as can be seen from one undergraduate comment below on the fact that she barely used it outside of the seminar.

> US: Like you are only using it in the seminar, but other than that you don't have anything else to add. So, we just share our ideas in the seminar and other than that I don't think we use it.

However, many students did discuss taking care over what they wrote while simultaneously freely expressing personal opinions.

> US: I looked at it at the start just to get an overview of what we did in class especially before the test.

US: I always forget to go on it but I've been on it twice. I don't look for references or anything like that.

LR: So what do you go on it for?

US: To see what I'd written the week before because I remember spelling something wrong.

LR: So did you go back and change it?

US: Yeah.

US: I've been on it a few times just to look.

LR: At what you'd written or what other people had written?

US: Both.

With a little encouragement students began to voice their own opinion and write. Knowing they were writing for the seminar audience made them conscious of their writing, knowledge, and understanding, encouraging some to reflect on what and how they wrote. Some undergraduates described the benefits of having this resource and while the use of the wiki was not directly related to any form of assessment, some students used it to remember seminar content and access useful references for their timed test essay. Approximately a third of students referred to references available on the wiki in their assignment; they referenced these sources directly, rather than referencing the wiki site as directed in the wiki do's and don'ts list at the start of the module.

LR: Did anybody use it at all for the assessment?

US: Yeah, I looked over it.

There is evidence that the undergraduates did use the wiki in addition to their lecture-based notes and independent reading material to aid their writing in the timed test essay question. Some students cited the wiki references and arguments in their assignment. However, not all used it this way and some engaged with the wiki more than others.

Levels of Participation

Participation is depicted as central to situated learning, since it is through participation that identity and practices develop (Handley et al., 2006). Within the theory of situated learning, participation is not just viewed as a physical event or action, but rather, it involves both taking part (action) and connection (Wenger, 1998). The connection element is harder to accomplish and arguably harder to document, however there was evidence of a community of practice amongst the undergraduates whereby they discussed the significance of peer-group learning outside of their physical seating arrangements within class.

> US: It feels like you are actually one big group instead of just a table.

Undergraduates also acknowledged the potential for conflict of ideas and recognised that each student brought a different history and context to the wiki that was negotiated and to some extent mediated by the wiki seminar group.

> US: I think it's good because it gives us a different perspective, I might think of something and somebody else might say it differently, but in a classroom that might not happen because some people might not feel comfortable in expressing their opinions. Especially if you write something that is not popular so if I had something to say which was different from what everybody else was saying I would just agree with what they were saying.

> LR: But do you put anything controversial up there?

> US: When we did the definitions I'm sure that everyone had different definitions. So, if a different group did the same definition everyone would have different things to write.

Situated learning theory emphasizes that learning is not just about developing one's knowledge and practice; rather, it involves a process of understanding who we are and in which community of practice we belong (Handley et al., 2006). Some felt more part of the community than others and there was evidence to suggest that subgroups within the overarching seminar session helped some to gain confidence in voicing their opinion and writing. Building up these safe writing environments takes time, careful management, and an understanding that peer-group learning takes on a life of its own in terms of who and how people share and write ideas. There are different forms of participation ranging from "marginal" to "full" and not everyone achieves full participation at all times (Wenger, 1988). The dynamics of power and familiarity operating within the community of practice may affect levels of participation and it is up to the educator to mediate these to enable all learners to benefit from the community of practice.

Conclusions

Essay writing is a standard practice many undergraduates are expected to demonstrate as it is thought to promote higher-order thinking (Smith, Campbell, & Brooker, 1999) and is associated with deep learning (Xiao & Luckling, 2008). Peer feedback has been viewed as an effective strategy used to improve student writing skills and learning achievement (Slutsky & Wilson, 2004) and, as such, was implemented within this seminar via the use of the wiki to facilitate collaborative learning and improve undergraduates' academic writing capabilities. The use of the wiki enabled some undergraduates to voice their own opinion, capitalize on their own individual experiences, and write.

In addition to providing graduates with the requisite knowledge to teach in their respective fields, the doctor of philosophy (PhD) degree is aimed to prepare students to conduct original scholarly research for the dissertation and beyond (Fleming-May & Yuro, 2009). By integrating a PhD student into the community of practice, she gained valuable experience contributing to the doctrine of an undergraduate course and assisted with the online discussions. It acted as a forum for the postgraduate to familiarize herself with HE teaching and enhance her and my repertoire of pedagogical teaching and learning styles.

Collaborative learning is an excellent way to optimize undergraduate, postgraduate, and lecturer skills and knowledge; it also provides a fertile safe ground to practice writing, whereby meanings are shared, renegotiated, and revisited. The wiki is one way of providing this flexible peer-group orientated space, but careful, constant management and direction is also required to oversee levels of participation within and beyond the community of practice and encourage student participation. Future work may want to review the longer-term effects of using such techniques to decipher their potential impact across other learning spheres over a prolonged period.

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