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Empowering 21st century assessment practices: Designing technologies as agents of change

Abstract

The overarching questions guiding this research study is *how might new assessment technologies help K-7 educators visualize learning and how might these visualization approaches inform educators' changes in classroom assessment?* One component of this interprofessional, designed based research study explored how K-7 educators' assessment practices of 21st century classroom learning might change when introduced to FreshGrade, a new suite of assessment software tools. Seven primary educators (grades K-3) and two intermediate educators (grades 4-7) participated in this study. Across the three data collections, all participants reported the importance and challenges of capturing learning artifacts in their classrooms that meet the following characteristics: interactive, personalized, collaborative, creative and innovative. Reflecting on their experiences, these educators reported more confidence using the software while working within this interprofessional team of researchers, educators and software developers. Based on these educators' reflections, the researchers discuss how this study may have provided opportunities for 'in-the-moment' professional development to occur.

Introduction

Currently, provincial policy makers and K-12 curriculum specialists across North America determine skill sets and learning competencies to assist learners reach their full potential as lifelong learners and active global citizens (i.e., Alberta Education, 2007; BC Ministry of Education, 2010a; BC Ministry of Education, 2010b). As K-7 educators shift their

practice from a teacher-centred to learner-centred approach, they increasingly are challenged to exchange their daily planners with linear lesson plans and standardized tests to dynamic mesh-work systems of information including individual, small groups and whole-class learning activities (Hawley & Valli, 1999). As these educators are called upon to become designers of learning activities and environments, their existing assessment strategies are challenged to balance / account for personalized learning, context, content and design components. Concurrently, researchers caution that educators must monitor and assess the results of these activities, and then, be prepared to interpret and communicate these results to learners, administrators and parents in a timely manner (Singh, Granville, & Dika, 2002; Walberg, 1999; McBride, 2004). Thus, administrators and educators are searching for new tools and technologies to capture and assess these multiple learning artifacts within a complex learning system. However, to promote sustainable change, Floridi (2010) observes "information societies increasingly depend upon technology to thrive, but they equally need a healthy, natural environment to flourish" (p. 119). Rather than thriving and flourishing, many educators report radical and disruptive changes to their professional practices as they are being asked to teach in ways in which they were not taught themselves (Jacobsen & Crichton, 2003).

Aware of the potential for disruptive and radical changes to educators' classroom practices, administrators may attempt to support these educators through professional development. However, to address each educator's challenges of scaling innovative practices and adopting educational change, research (Pegler, Kollewyn, & Crichton, 2010 and others) suggests that professional development may not be considered as a one-approach solution. Meeting the varying needs of these educators, professional development must be a continuous, just in time

activity aimed at individual educators' adoption stage (Rogers, 1983) and career cycle (Steffy, Wolfe, Pasch, & Enz, 1999).

To better understand the localized context of innovative classroom practices and educational change, this study brought academics, researchers, software developers, and K-7 educators together using a design based research (DBR) method (Kelly, Lesh & Baek, 2008). The research was funded through a Canadian not-for-profit research organization called Mitacs and supported by the Innovative Learning Centre (ILC) at UBC's Okanagan campus. Mitacs funds such collaborative research amongst companies, government and academia to foster innovative industry solutions to be tested through a participatory assessment approach (see http://www.mitacs.ca/about for further information). The ILC provides interactive spaces and places where educators, industry members, community providers, K-20 learners, and researchers explore the future of education together (see http://blogs.ubc.ca/centre for further information).

For this DBR study, an interprofessional group including academics, researchers, educators and software developers explored a new cloud-based assessment tool called FreshGrade. The overarching question guiding this research study included two parts. First, how might new assessment technologies help educators visualize learning in their classrooms? Second, how might these visualization approaches inform educators' changes in classroom assessment? Sub-questions included: What data, feedback, or assessment might educators collect to support sustained dialogue with members of their learning environment – administrators, parents, community service providers? What learning artifacts become useful to K-7 learners as they learn to advocate for their own life-long learning opportunities and challenges? Although unique findings were discovered for each group of professionals, this paper will focus on the K-7 educators who volunteered for this study.

To begin, this paper explores the localized context and background of this study. Two overviews follow: first, interprofessionality, an emerging concept in health and social care systems (D'Amour & Oandasna, 2005); and second, design based research (DBR), an approach to action-based modes of inquiry (Kelly, Lesh & Baek, 2008). Next, the data sources and results of the study are introduced. Finally, the scholarly significance of this study is discussed. This discussion focuses on how introducing new assessment software tools amongst a group of interprofessionals may provide opportunities for sustainable change in educators' assessment practices while designing 21st century learning activities in their classrooms and for innovative technological solutions.

Context

This research study provided a foundation of theory and current K-7 educators' practices within a localized setting to assist software developers prioritize their future design and development of assessment technology called FreshGrade. To begin the study, FreshGrade representatives worked with various school board administrators to identify prospective schools and participants. Two school boards were chosen and school administrators were asked to identify K-7 educators who were recognized as having developed 21st century teaching and learning environments in their classrooms. Representatives of each board initially contacted educators. The researchers then followed up those educators and explained the study before asking for volunteers. From this group, seven primary (K-3) and two intermediate (4-7) educators agreed to participate in the study. Three participants were from a single school within one school board and six participants were from various schools in the other school board.

All participants were experienced educators who were recognized for having designed 21st century learning activities and developed ways of making meaning of each learner's

progress through common core curriculum using existing software or hardware tools (e.g.

Evernote or paper-based portfolios as well as other available options). Concurrently, their

administrators were discussing how best to support these rapidly changing learning environments

through professional development. The researchers observed, surveyed and interviewed these

educators as they beta-tested FreshGrade in their classrooms. In turn, the research findings

informed the software developers as they prioritized future design and development of

FreshGrade.

Background

Current learning sciences and educational research (Fischer & Immordino-Yang, 2008)

argues for change in the classroom practice of assessment data collection to reflect learning that

is authentic and social and that allows students to build mental models, become internally

motivated, and use multiple intelligences (Trilling & Fadel, 2009). When implementing these

approaches into classrooms, learning becomes more interactive, personalized, collaborative,

creative and innovative, which challenges existing assessment practices.

For K-7 educators, applying this research in the classroom means more time spent in

designing personalized learning activities and less time teaching. Additionally, educators'

classroom practices will require more time for personalized assessment and feedback to promote

learner's success. With this learner-centred approach, educators require formative assessment

practices and skills to formally and informally gather information about their students' learning

achievements and behaviours throughout the learning activities (i.e., evaluation and feedback to

reinforce understandings and uncover misunderstandings). Researchers suggest formative

assessment deepens learning (Earl, 2003; Wiggins & McTighe, 2006). In comparison, more

traditional assessments score end-of-teaching performance tasks after the completed learning

activities (i.e., final examinations or culminating projects). By understanding the needs of K-7 educators to change their assessment practices, software developers inform their decision-making process for future design and development of cloud-based suites of digital assessment tools. FreshGrade, the software explored in this study, was designed to provide educators with a suite of digital assessment and feedback tools to gather meaningful collections of each learner's artifacts in the classroom. While the FreshGrade software developers did not participate in data collection or have access to raw data, the feedback / suggestions from the K-7 educators were shared during meetings with the researchers and the software company principle developers. The feedback / suggestions and discussions were key to this study as they provided interprofessional discussions between educators, researchers, and software developers. Additionally, they gave criteria to determine an implementation for the design based research.

Interprofessionality

To enhance the participatory assessment approach of technology of the FreshGrade software, the researchers chose to apply an emerging theoretical concept in health and social care systems, interprofessionality, defined as

> … the development of a [socially] cohesive practice between professionals from
> different disciplines… by which professionals reflect on and develop ways of
> practicing that provides an integrated and [socially] cohesive answer to the needs
> of the client /family/ population … through continuous interaction and knowledge
> sharing between professionals organized to solve or explore a variety of education
> and care issues … [and] a means by which professionals can practice in a more
> collaborative or integrated fashion (D'Amour & Oandasna, 2005, p. 9).

To provide an opportunity for educators and software developers to determine a socially cohesive solution, the researchers attempted to enhance the efforts of these professionals to solve a complex issue — capturing and visualizing learning in a K-7 classroom — without creating another challenge in its place. Throughout the study, educators and software developers continuously interacted through feedback loops and were informed by researchers of new knowledge discovered throughout the beta-testing. To this end, interprofessionality and collaboration, a learning method using social interactions as a means of knowledge building, brought these two professional groups in this study closer to a shared representation of common goals while respecting each individual profession's contribution to the study (McInnemey & Roberts, 2004, p. 205). As an example, rather than enforcing consensus among the educators and software developers to define 21st century learning, the researchers sought multiple perspectives, shared representations, and mental models throughout this study, as described below.

Early in the study, school administrators and educators were asked what opportunities this study provided them. Overall, they reported this study would provide an opportunity for professional development capturing 21st century learning and inform the development of new software, namely FreshGrade. During knowledge exchanges with researchers, the educators were asked to review their current personal designs of learning activities. Overall, they explained their design and implementation of personalized learning activities requiring 'in-the-moment' assessment and feedback strategies (Trilling & Fadel, 2009). Concurrently, these educators described how their strategies must also complement their particular localized educational policy initiatives, adapt to their classroom practices, present seemingly invisible targeted interventions within the classroom, and promote meaningful dialogues between all collaborators involved in

each learner's progress — educators, parents, administrators, and community practitioners. Moreover, many of these educators described their learners with multiple socio-economic risk factors. Subsequently, as they designed learning activities, these educators included unique inter-activities that influenced each learner's personal resilience and vulnerability. Overall, these K-7 educators designed and implemented learning in mindful and meaningful ways to engage their learners and develop literacy skills through play and / or inquiry. After implementing, capturing, and reflecting on each learning artifact, these educators then determined how 'evidence of learning' would be shared or reported formally and informally. When these shared representations of K-7 educators were presented, the software developers were more aware of what these educators meant by a meaningful software strategy to include the complexity of their learning systems and an inclusive learner-centred approach — for example, providing evaluation and feedback to reinforce understandings and uncover misunderstandings — and how these educators might be supported through professional development.

James Flynn (intelligence researcher) defines these shared representations, or mental models, as shorthand abstractions (SHAs) where "concepts drawn from [natural or social] science have become part of the language and make people smarter by providing widely applicable templates…" (as cited in, Brockman, 2012, p. xxx). Professional or disciplined knowledge domains include SHAs through specialized language and skill sets that form 'a professional practice'. Concurrently, other professionals and the general public have claimed some specialized words and created SHA 'buzzwords' for talking *about* these practices rather *doing* these practices (Cornwall, 2007). One outcome of this 'buzz' is words like 'development', 'design', 'assessment', or '21st century learning' becoming "a perception which models a reality, a myth which comforts societies, and a fantasy which unleashes passions" (Sachs, 1997, p. 1).

Amongst these perceptions, myths and fantasies, as others (i.e., policy makers, software developers) take up the 'buzz' about social issues surrounding these words, those *doing* the practice (i.e., educators) may not bother, or find the time, to reflect on their knowledge creation and transformation being produced. Cornwall (2011) contends when professionals reflect individually and dialogue collectively, they evoke those bigger questions involving societal issues and provide opportunities to define and describe possible solutions.

In this study, the educators' reflections and collective dialogues were couched in the beta testing of FreshGrade. Further, by using design based research for this study, care was taken by the researchers to address each professional's mental model of 21st century learning to ensure a socially cohesive understanding of the challenge to be solved was reached once the study was completed.

Design based research (DBR)

Design-based research (Kelly, Lesh & Baek, 2008) is a form of action research that introduces iterative data collection to inform research and development of technology solutions in real world problems, determine systematic interventions, and measure change in actions once the intervention has been implemented. In addition, participants are highly involved in the research process. Design-based research is distinct from action research in two aspects: the goals of the research to solve authentic problems and the use of research findings to inform subsequent design decisions. One authentic problem was the multiple perspectives of 21st century learning and how best to capture instances of learning in the classroom. Initially, educators and software developers only understood their mental models of 21st century learning and in many instances disregarded each profession's nuances or meaning of this seemingly common language when shared across professional practices. In turn, these unique perspectives determined how

participation in this study might be impeded or enhanced as the researchers presented the shared representations from each professional practice, either directly or indirectly. This iterative process bridged some misconceptions from both professions and informed design decisions for both the educators as they designed new learning activities and the software developers as they prioritized future design and development of FreshGrade. A real world problem arose during the study. Originally researchers planned to observe the educators as they planned, delivered and assessed classroom learning over a four to six week period. Independently, all educators felt classroom observations were not warranted. Alternatively, they described their experiences with this new software tool, FreshGrade, in their classrooms.

Data Sources

The three data sources for this research included an online survey, workshop observation, and semi-structure interviews. For this paper, three themes across all data sources will be described. First, a recurring theme noted by the researchers across all data sources was how the participants' perspectives changed when self-reporting their technology skill and comfort level as compared to their responses in their initial online survey. When asked in the interview about their technology skill and comfort level, three participants changed their response from 'regular ' to 'power' user in the span of four to six weeks. They reported they felt empowered and comfortable enough with FreshGrade to demonstrate the assessment tool to colleagues. During the interview, educators were asked if they planned to continue using the software once the study was complete. Four participants reported that they planned to continue using the software until the end of term and learning new features (i.e., attempting to transfer data to report cards). Three participants were not sure whether they would continue or not and two of the nine participants stated they only used FreshGrade during the study. It is important to note, that the teachers were

trialing only the beta version of the software, so their willingness to adopt it in their practices might have been impacted by the software itself.

Next, all educators described FreshGrade as first, having potential, and second, very easy to use. The potential and ease of use was reflected in the 13 usability statements discussed during the interview. Further, when asked to base their answers only on the functionality available while testing FreshGrad*e*, all participants who had used the feature answered 'yes' or 'has the potential'.

Finally, from their descriptions of "some of the frustrations" the educators encountered with the assessment tool, a 'Top 10 Wish List' was compiled for the FreshGrade software developers. Of note, every participant mentioned the following top three wishes:

1. 'On the fly' anecdotal entries as well as numerical entries

2. Ability to group / re-group learners as well as input individual feedback and assessments

3. Audio / video artifacts included as capture (i.e., shows fluidity of reading from start to end of year, peer review, interactions during group work, examples of a 'learning moment')

When these three wishes were presented to the software developers, they reported these enhancements to the software were already on their 'next steps' for future design and development. This wish list surfaced an interesting challenge for the interprofessional nature of this study as well – just because the group of educators wanted a change, it might not have been possible within the software functionality or considered as priorities by the software developers.

Results

The K-7 educators in this study reviewed their approaches to the designs of learning activities, reflected on their experiences, and engaged in knowledge exchanges with colleagues, researchers and software developers. These participants reported how they had designed and

implemented effective 21st century learning activities in their classrooms. These learning activities included multiple assessment and feedback strategies. For example, one participant reported

> … in my classroom my kids have a lot of choice in learning within my Grade 1 class, and so I may have 10 different choices for one learning outcome, prescribed learning outcome from the [BC] Ministries … so right now my kids have their own blogs and I will go to those blogs to access learning … however, that is not the only thing that is happening … we are running in a million different directions and doing a million amazing things … because personalized learning is so important … (*Educator – Coded as TAUNT169576*).

When the description of classroom activities was combined with the educators' shared representations of 21st century learning and assessment, software developers had a better understanding of the educators' needs within the classroom.

Two participants' descriptions encapsulate the ideas and desires of the seven participants who described what a 'perfect assessment system would look like'. The first participant (*Educator – Coded as TAUNT 1517866*) stated the potential of a 'perfect system' seemed obtainable with today's technology and described it as

> …being able to record students reading, have them listen to it as well as their parents. Assessing students on their sight word knowledge on an iPad or computer, having that information stored, so that students can practice on their own as well. Having all assessments stored in one location. Being able to take pictures of students work, video of them working and having discussions with each other.

The second participant (*Educator – Coded as TAUNT 134982*) prefaced the response with

"[m]y knowledge is very limited when it comes to design and development, and 21st

century learning, skills and assessment methods / techniques are very new to me;

therefore, my response may not be adequate or answer the question as expected.

However, this self-reported User (answered "I use technology only in my work"), Gen X (born

between the years of 1965 and 1978), Distinguished Teacher (10 plus years teaching experience;

I am recognized as a recognized leader in my school / district) articulated most of the features

described by other participants as 'a perfect system' based on their localized setting:

… from my current vantage point, I would like to have the ability to access and

manipulate the following:

- BC Ministry of Education prescribed learning outcomes
- BC Ministry of Education performance standards (Reading, Writing, Numeracy, and Social Responsibility)
- A grade book that is simple to use with the ability to include anecdotal comments with a numerical value

I would like to have the capability to:

- Create, update and print long range, unit and daily lesson plans
- Record student work samples (visuals)
- Create student folders and files- record students reading (audio)
- Create student folders and files
- Store student specific information-parent email, phone numbers, allergies, photo restrictions, special needs notations, etc.

I would like the system to be:

- User friendly for someone with limited knowledge / simple to use
- A natural extension that supports the busy classroom teacher, as opposed to a time consuming process that is extra work

- ▪ Useful, [a technology] that makes me think "How did I manage all these years without this system?"

These findings emphasize these K-7 educators willingness to change their practices from more traditional assessments score end-of-teaching performance tasks after the completed learning activities (i.e., final examinations or culminating projects). As one participant responded

> … to be honest I'm not sure what my district's policies are (officially) but I do know that I am highly supported when my class and I use technology to analyze information, collaborate with others, create, and problem solve. I have choice of the assessment tools I use, with the exception of the tool my admin has chosen for our school goal. I know that new (different / individualized) ways to assess are okay. What is important is that I look at each student as a unique individual and find the best way to allow them to show me what they know, and that's what I assess. (*Educator – Coded as TAUNT169576*)

In conclusion, the results of this design based research study have shown how an intervention — introducing FreshGrade software in the classroom as a beta-test to educators with 21st century assessment practices into their classrooms — seems more than a simple building block of professional development. Rather, this intervention may be considered a threshold concept. A threshold concept is seen as something distinct and typically described as a concept that changes an individual's 'core concepts' (Kiley & Wisker, 2009). A threshold concept is one that "once its potential is understood, leads to a qualitatively different worldview of the subject matter and / or learning experience" (p. 432). Further, as an adult learner… once this concept is experienced and understood, such learning experiences lead to changes in perception of the subject and a possible shift in identity. For example, in the beginning of this study, three teachers self-reported as 'regular users' when using technology. However, after four weeks of using the

FreshGrade technology, they were able to 'see' themselves as 'power users'. Therefore, the experience of using FreshGrade within this research design gave them a new perspective of their technology skills and comfort level.

Scholarly significance

Through this study, the beginnings of a working model, including interprofessionality and design based research, may be constructed and modified to meet varying perspectives and circumstances. The research findings contribute to understanding how professionals with unique knowledge domains (specialized professional languages, jargon, and skill sets) and localized contexts negotiate socially cohesive technology solutions. Preliminary findings suggest the participants in this study have the potential of beginning a community of interprofessional practices. For K-7 educators and software developers, such a community would include discussions to map the shorthand abstraction of 21st century learning and assessment practices to appropriate technologies. These discussions require each profession taking time to share their mental models and take time to understand others' mental models. Further, disruptive and radical changes in professional practices may be driven by information societies and available technologies but they are also driven by the winds of political, economic and societal changes that create a 'buzz' and may determine unrealistic expectations of technology use within K-7 classrooms.

As evidenced in this study, educators require personal awareness, reflection and the support of a community of interprofessionals to differentiate between policies and practices that are cutting edge or just trendy. Changes must be considered in light of the potential impact to the individuals and their community, not for the sake of change itself. Concurrently, designing and developing in concert with academics, software developers, and researchers may have given

these participants an opportunity to consider technology as an agent of change, rather than a waster of time and resources.

Yet, too often policy makers, curriculum specialists and others will create the 'buzz' for these educational changes while educators in the classrooms are attempting to adjust their radically disrupted practices. When determining the next steps for educators within such complexity, it is vital to address the human costs as well as the fiscal, tangible costs of such changes. Providing interprofessional evaluation and feedback in iterative stages may help identify changes that may be perceived as a 'ripple' effect to one profession does not create a 'tsunami' for another. As mentioned in the introduction, a goal of the Innovative Learning Centre (ILC) is to bring interprofessional groups together to imagine the future of education together through various activities: professional development, think tanks, research, etc. In this study, sustainable technology solutions for complex social issues may be seen as radically disrupting the core concept of 'best practices' for educators. Yet, these solutions may also disrupt the needs and / or 'best practices' of others involved in this complex social system including policy makers, K-12 curriculum specialists, software developers, academics, learners, and parents.

To measure the impact and potential sustainability of such technology designs and developments through an interprofessional, design based research approach adds to the growing literature and research across various professional fields (i.e., professional development, technology-enhanced learning environments, curriculum studies). As new highly competitive economic global "players, playing fields, and processes" (Friedman, 2005) rapidly emerge, the future of any professional social systems (i.e., health, social care, education) have been characterized by high degrees of risk and uncertainty (Ramírez, Selsky & van der Heijden, 2010). To cope in these turbulent times, various groups of professionals within these social

systems may shift and / or change directions. These shifts may require professionals to developing the need for new skills, core concepts and, in some cases, 'best practices'.

Professionals interact in their social world through a common chain of discourses, symbols and communications with clients. Analogous to a journey rather than a destination, professional competence develops by a "habitual and judicious use of communication, knowledge, technical skills, [critical] reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and community being served" (Epstein & Hundert, 2002, p. 226). Therefore, every professional experiences a daily practice spanning "across time, situations, and problems through the exercise of professional judgment" (Nelson, 2007, p. 12). When asked to participate with other professional groups to solve complex social issues or real-world problems, specialized language and / or skill sets may deter the intent of a socially cohesive solution. This disruption from 'common practice thinking' provides professionals an insight to the importance of "[p]rofessional competence [as a] developmental, impermanent, and context-dependent" (Epstein & Hundert, 2002, pp. 227) practice. This key insight becomes significant when bringing different groups of professionals together since

> … once certain practices become the norm, once they are seen to bring benefits and to circumvent troubles, once they are reinforced by social approval and disapproval, they do of course seem to reflect the one and only right way for things to be … (Churchland, 2011, p. 59).

Through these norms in their professional practices, professionals develop two personalized professional acts: knowing-in-action and reflection-in-action (Schön, 1983).

Knowing-in-action describes the professional's ability to draw on their tacit knowledge to bridge the gap "artificially created between acting and thinking" (Schön, 1983, p. 50). As

compared to professional or explicit knowledge, Schön describes tacit knowledge as "implicit in our patterns of action and in our feel for the stuff with which we are dealing with" (p. 49). Therefore, as professionals practice in social systems where daily situations and problems repeat in similar patterns, they develop their tacit knowledge to automatically and intuitively assess new situations or problems. Tacit knowledge is difficult to transmit through written or oral communication forms from one professional to another since 'the stuff with which' professionals deal with is developed through their daily practice and may be confounded by their social presence (i.e., historical, social and cultural factors).

Reflection-in-action describes the professional's ability to draw together the gap between 'knowing-in-action' and an unfamiliar situation or problem within daily practice. Schön (1983) describes such actions as originating in the reflective practitioner's "perception of something troubling or promising" and evolving into a "production of changes one finds on the whole satisfactory, or by the discovery of new features which gives the situation new meaning and changes the nature of the question to be explored" (p. 151). Such embodied actions require professionals to think, act, do and communicate with their clients in "the form of a literally reflective conversation" (Schön, 1983, p. 295). For the reflective practitioner, these conversations "recast the relationship between research and practice" while "the exchange between research and practice is immediate and reflection-in-action is its own implementation" (pp. 308-309). Such implementations may be difficult to replicate or generalize from one professional to another since 'the exchange between research and practice' is designed through their professional experiences and may be confounded by their cognitive presence (i.e., attentiveness, critical curiosity, and self-awareness). These actions serve them well in their daily practices; however, may deter a collaborative process with other professional groups.

Specifically, in this DBR study, the researchers explored how software developers and K-7 educators might be involved in a participatory assessment approach. By introducing interprofessionality, these professionals were introduced to descriptions of any disruptions in their practices, processes of finding socially cohesive solutions, and shared representations of the larger social issue that brought them together through this research study.

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