PRACTICING TEACHERS AS DIGITAL GAME CREATORS: A STUDY OF THE DESIGN CONSIDERATION

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ABSTRACT

This research intends to explore practicing teachers' experiences with game design and development. Specifically, the study is guided by the following research questions:

1. *What design considerations were taken into account during the game design process of practicing teachers?*
2. *What pedagogical components (if any) emerge when practicing teachers design and build digital games?*

Employing a naturalistic and qualitative approach, data are collected from 32 graduate students who participated in the study. The analysis of the games created by these practicing teachers indicates some key themes: (A) curriculum goals were predominantly the games' objectives; (B) sounds and animations provided visual appeal and feedback; (C) the game could be or needed to be used with supporting materials within the class; (D) the need to create a sense of accomplishment for the gamer; and (F) the emphasis of the gamer being able to project or customize his/her identity within the game. Further discussion is also provided.

INTRODUCTION

We are moving towards a participatory culture where 21st century literacy skills are essential in fostering membership (Jenkins, 2007). Developed at the New Media Consortium in 2005, 21st century literacy skills are defined as

> ...the set of abilities and skills where aural, visual and digital literacy overlap. These include the ability to understand the power of images and sounds, to recognize and use that power, to manipulate and trans-form digital media, to distribute them perva-sively, and to easily adapt them to new forms (The New Media Consortium 2005, p.2).

Learning-by-game-building can foster the development of 21st century skills by creating a context for one's own learning. The benefits of learning by doing produces empowered learners who are the manufacturers of their own situated learning (Gee, 2004). Kafai (2006) asserts that putting the task of designing games into the hands of the learner allows them "to construct new relationships with knowledge in the process...[which conceivably holds] more potential for engaging children's enthusiasm for games in the service of learning"(p.38). Further development of skills such as analysis, synthesis, evaluation, and revision are a focus of the design process, which in turn enhance meta-cognitive skills (El-Nasr & Smith 2006).

If practicing teachers want to cultivate these emerging skills in their students, they must attain them first-hand. Their deepened understanding of the 21st century skills would enable teachers to guide students in a richer, more-technologically embedded learning environment. The learning-by-game-building approach is proposed to provide teachers with the opportunity to cultivate these skills. Teachers have the potential to build a game that best aligns with the educational goals and needs of students due to

their expertise and experience with the curriculum, their students, and educational contexts. The game-building approach places emphasis on process over product, making it imperative that practicing teachers are well-experienced in this process in order to facilitate student learning through this approach.

Empirical studies have been performed on game-building with a primary focus on students and how teachers can best incorporate this approach within the classroom (Kafai & Carter Ching, 1996; Robertson & Howells, 2008; Li, 2010). Limited research exists spotlighting practicing teachers as the principal learners and creators of educational games (Koehler & Mishra, 2005; Milken Exchange on Education Technology, 1999). This research, therefore, explores practicing teachers' thinking and experiences with game design and development in the emergent participatory culture, grounded in enactivism.

THEORETICAL FRAMEWORK

Enactivism is grounded in the system of knowledge creation between agents, amidst experiences, and within environments. Interrelations between these concepts create a unique outcome that is not predetermined but based on the agent's past experiences and current knowledge (Proulx, 2004). Rejecting dualism, enactivism considers mental and physical domains are inseparable (Li, Clark, & Winchester, 2010). "All doing is knowing and all knowing is doing" is a signature slogan of this view. This theoretical framework also proposes the notion of knowledge co-authoring. Within the context of game building, enactivism also asserts that the design process is influenced by the designers' cognitive processes which in turn affect the product (Li, 2010). That is, the designers' previous experiences enact and inform the design process. Through this process, the designer is instilled with new skills and awareness that encompasses the designer's thinking, doing and learning (Li, 2010).

Grounded in the enactivist perspective, practicing teachers in this study are invited to build games by incorporating their content and pedagogical knowledge within the design elements through an active, iterative approach. The game-building experience is hands-on, allowing practicing teachers to interact with the game-building process and programs. The research is working under the assumption that the design processes will inform and transfer to digital games.

LITERATURE REVIEW

Computer game design as a form of educational activity is an increasing area of research (Tiong & Yong, 2008). The link between student learning with technology, specifically a hands-on approach with students designing and constructing their own learning was studied as early as 1960's by Seymore Papert and colleagues. Since then, the concept of digital learning with technology and games has been explored more in depth (see Hsiao, 2007; Kirriemuir & McFarlane, 2004). Digital game-based learning is a promising area of research and debate including the topics of fostering contextualized learning, creating and harnessing motivation in learning capacities, encouraging and endorsing curiosity, and offering a collaborative platform for harbouring knowledge (Gee, 2003; Shaffer, Squire, Halverson & Gee, 2004; Paras & Bizzocchi, 2005; Prensky, 2006; Kirriemuir & McFarlane, 2004).

Children today speak a more advanced digital language due to their (native) upbringing within a substantial technological presence in comparison with their parents or teachers who are now considered "digital immigrants" (Prensky, 2001). Prensky (2001) sheds awareness on gaps that have emerged between teachers who either pre-date or are disconnected with the technological presence of the last twenty years and their students. With technology, students are plugging in on a daily basis, not only adding to and commenting on the content presented in social networking sites but also authoring digital content in the form of blogs, websites, and games.

Being involved in this participatory culture has unintentionally compelled participants to discover new fact-finding, content, and technical skills which enable them to enhance their new media literacy skills (Jenkins, 2007). Burdick and Willis (n.d.) have further posited that "literacy itself is situated, networked and contingent...and continually negotiated...Design thinking...specifically supports this constant emergence" (p.3).

Designing and creating in this digital environment are aspects of gaming literacy (Zimmerman, 2007). They are embedded within the social skills necessary to interact within a larger community (Jenkins, 2007) and are also criteria for the acquisition of 21st century skills. Due to students' on-going relationship with technology, learning-by-game-building has encouraged researchers to perform empirical studies in the subject areas of mathematics (Harel, 1991; Kafai & Carter Ching, 1996; Noss & Hoyles, 2006), computer science (Korte, Anderson, Pain & Good, 2007) and science (Kafai, Carter Ching & Marshall, 1997; Li, 2010). In these studies, students' game-building experiences were analysed and interpreted in order to find patterns, processes, and connections between building and learning.

Proponents of learning-by-game-building are looking at digital literacy skills fostered in teachers for the purpose of training teachers to facilitate burgeoning 21st century skills among students (Becker, 2007; Gee, 2003). Teacher training in technology and the use of digital games in the classroom is considered to be a proactive method to keep up with the technological skills of students (Brand, 1997; Capper, 2000; Tan, Hu, Wong & Wettasinghe, 2003; Becker, 2007). Relating to teacher-built games, there is less dialogue.

It has been posited that teachers should not be the primary designers of curricular content in educational digital games because teachers "don't fully understand the minds

of today's students" (Prensky, 2008, p.1005) and "often, educational games...created by educators or textbook publishing houses smell too much like school" (Lim, 2008, p.1002). Becker (2007), however, asserts that educating teachers on strengths and limitations of digital games through first-hand experience allows for positive and effective embracing of digital games within the classroom. Other views propose training teachers in design thinking to incorporate a trio of content, pedagogy and technology. Additionally, "by participating in design, teachers build something that is sensitive to the subject matter (instead of learning the technology in general) and the specific instructional goals (instead of general ones)" (Koehler & Mishra, 2005, p.135). It is yet uncertain if these views are indeed opposing and concrete, as further empirical studies need to be conducted to explore these differing perceptions of students-as-designers vs. teachers-as-designers.

Koehler & Mishra (2005) conducted seminars that gauged teachers' content assessments with knowledge integration and observed practicing teachers design and construct online courses. They felt that the use of technology had to be grounded in sound pedagogical and content knowledge and such training courses needed to be provided to practicing teachers. Fuhrmann, Kali & Hoadley (2008) observed graduate students in education create technologies for learning through design and found that designers' epistemological beliefs were being challenged and realized through the design process as they were simultaneously integrating academic learning and design thinking. Repenning & Lewis (2005) proposed a partnership with practicing teachers and undergraduate students in computer science. This would occur in order to provide design balance in engagement with learning, as instructors may not have appropriate technical skills to build a digital game. They also promoted an IT component of practicing teachers' certification.

Although empirical studies are being performed in different settings, research into teachers' game building experiences is still in its early stages. Our research puts the task of designing and implementing a game in the hands of the practicing teachers. Through this, teachers learn through technology and use design elements in order to build a digital game thereby co-authoring their own digital learning.

RESEARCH QUESTIONS

Focusing on practicing teachers' game-design and building experiences, this study was guided by the following research questions:

- What design considerations were taken into account during the game design process of practicing teachers?
- What pedagogical components (if any) emerge when practicing teachers design and build digital games?

METHODS

The research employed a naturalistic and qualitative approach, focusing on the occurrence and development of design elements within the planning and implementing stages of practicing teachers' digital games. Through the principal method of the case study, design elements were examined providing insight as to the considerations and deliberations included when practicing teachers designed and built their own digital games.

PARTICIPANTS

The participants were all practicing teachers (hereby known as teachers) taking a graduate course in digital game based learning in a university in western Canada. The course was twice administered from January to April of 2010 and 2011. The first class consisted of 12 students (6 males and 6 females) and was administered on campus in a face-to-face format, while the second class was administrated online through an asynchronous learning management system to 20 students (11 males and 9 females) around the world, including Japan and various parts of Canada. The teachers had varying backgrounds, from K-12 to adult English as Second Language (ESL) teachers. They had different experience with technology, although none had any formal training with coding or game design.

The course was designed to introduce the use of digital games and gaming for instruction and learning. Gaming theories were explored and the use of commercial and educational games was investigated. Subsequent to the above topics, students were asked to produce a written document (hereby referred to as "design document") applying these theories, design elements, and game mechanics to the production of their own digital games. The final step was to implement the concepts outlined in the design document to the actual creation of a digital game in a digital platform of the participants' choosing. Pseudonyms were used in this paper.

DATA

The data for this study was obtained through work produced by the teachers in their respective courses, specifically, teacher-created design documents and their semi-developed games. Due to time constraints, many games were partially developed, whereby the developed portion best represented a segment or level of the game or the game as a whole.

The teachers had the option to work individually or in small groups. As a result, twenty-three teachers worked alone on their games, while there were three groups of two and one group of three. In total, twenty-seven design documents were generated by the teachers. The teachers had carte-blanche on their design aspects with no specific game-building program assigned. The design documents were created to thoroughly explain and define the teachers' educational objectives, curricular objectives, theories, rationale, and game mechanics. Teachers worked under the

guise of no limitations to both technical and pedagogical considerations in the written blueprints of their games. In this respect, the design documents provide insight to the teachers' ambitions and intentions prior to the development of their games.

The design documents were then used as blueprints for the actual building of games using any digital game platform. The teachers were free to incorporate all the characteristics outlined in their design document to their digital games or narrow down the features to a feasible digital representation. The teacher could also supplement the game with supporting documents that facilitated the digital game. These documents not only summarized any assumptions, background information, game rules, user testing to provide informal feedback to help the prospective gamer to navigate the digital game, but also outlined changes and challenges or constraints they had encountered.

Twenty-six digital games were created, of which only twenty-four were evaluated. Two games were not evaluated due to technical problems that prevented their evaluation. The evaluated games were built employing the game-designing platforms of Scratch, Kodu, Flash, Adobe Captivate, GeoGebra and StarLogo TNG. Table 1, outlines the developed games, the targeted audience, and platforms used.

All twenty-seven design documents planned game objectives around concepts and ideas that were inherently taught in the K-12 classroom or in adult education courses. Subject areas prevalently found in the design documents are illustrated in Table 3.

INSTRUMENTS

To evaluate the games, we designed a rubric (see Appendix 1) that examined the pedagogical aspects of game design. The rubric was developed over a period of approximately one month through an iterative process of discussion and evaluating games independently to determine areas that needed clarification. Consensus was reached on wording and evaluation criteria.

While the rubric development is explained in further detail elsewhere (Li et al., forthcoming), a brief description is offered here to provide background information. We started with consultation of existing literature of educational games, of various standards (e.g. NCTM Standards (2000), and discussions of what we felt were essential aspects of educational games. After the initial rubric was developed, 3 researchers independently evaluated 5 games using the rubric. We then met together to discuss each

Table 1
Teacher Designed Game Characteristics

Year	Game	Curricular Objectives	Subject	Target Audience	Genre/Taxonomy (Gros, 2007)	Platform
2010	Game EM	Order of Operations and Computations	Mathematics	Grade 4	Adventure - Question and Answer (Q and A)	Scratch
	Game BZ	Cartesian Grid	Mathematics	Grade 6	Strategy	Adobe Captivate
	Game FI	Identify 3-D objects/ 2-D shapes	Mathematics	Grade 1	Adventure	Scratch
	Game GM	Creating storyline and text	Language Arts	Grade 7	Role-playing game (RPG)	Scratch
	Game KJ	Balancing chemical equations/reactions	Science: Chemistry	Grades 6-7/ Science 10-24	Adventure - puzzle	Flash
	Game LC	Counting money	Mathematics	Games 4-7	Adventure - puzzle	Flash
	Game M	Order of Operations and Computations	Mathematics	Ages 6-9	Adventure - Q and A	Scratch
	Game MG	Ancient Greek Culture	Social Studies	Grade 6	Turn-based Strategy	Scratch
	Game SF	Childcare-giving	Life Skills	Grades 7-9	Simulation	Scratch
	Game TV	Historical figures (Newton, Cleopatra, etc)	Social Studies	Grades 4-6	Adventure - story-driven	Flash

2011	Game BS	Biome Eco-systems	Science: Biology	Grade 7 Science	Adventure	Scratch
	Game AL	Aquatic Eco-systems	Science: Biology	Ages 7-12	Simulation	Scratch
	Game BR	Novel study and application	Language Arts	Grade 6	Adventure - story -based	Scratch
	Game DFL	Driver's Handbook	Life Skills	New drivers	Simulation	Kodu
	Game ED	Body parts	Science: Biology	English as a Foreign Language (EFL) ages 6-10 (China)	Adventure	Scratch
	Game FDL**	Test generation	Teacher Training	SAIT instructors	Action - mystery	Adobe Captivate
	Game GC	Order of Operations and Computations	Mathematics	Grades 1-6	Adventure - Q and A	Scratch
	Game GT	Identifying musical notes	Music	Grades 1-6 Music	Action - skill and drill	Scratch
	Game IC	Novel study and application	Language Arts	Grade 3	Adventure - story -driven	Scratch
	Game PS*	Office management for physicians/clinic staff	Teacher Training Courses	Physicians/ Clinic Staff	Simulation	N/A
	Game LS**	Plant Eco-systems	Science: Biology	Ages 5-9	Simulation	StarLogo TNG
	Game PT	Chemical elements	Science: Chemistry	Middle School Science	Fighting	Scratch
	Game S	East Indian Culture	Social Studies	Grade 3 Social Studies	Turn-based adventure	Flash
	Game STC	Canadian history, culture and geography	Social Studies	ESL/New immigrants	Adventure - Q and A	Scratch
	Game QC	Cartesian Grid	Mathematics	Math 20-1/20-2	Strategy	GeoGebra
	Game YAK	Traffic rules	Life Skills	New drivers	Adventure - Q and A	Kodu
	Game NG	Canadian history, culture and First Nations	Social Studies	Ages 12-16	Adventure- Q and A	Kodu

*** THIS GAME WAS NOT DEVELOPED**

**** THESE GAMES COULD NOT BE EVALUATED DUE TO TECHNICAL PROBLEMS**

game, comparing and contrasting our evaluation and rationales, until consensus was achieved. We then evaluated several different games independently using the revised rubric first, and later worked collaboratively to modify the new version of the rubric. We also consulted several experts in the field, confirming the appropriateness of the rubric. This iterative process continued until we all satisfied with the criteria and believed it covered the essential components of the teacher-designed games.

The rubric measured the existence and prevalence of educational components in the design documents and that were tested in the game. The categories fell into three areas: knowledge components, game-play components, and playability. The knowledge components were designed based on the important aspects of pedagogy that teachers should demonstrate in the problems they posed within the games.

In this respect, problem solving, active learning, exploration and reasoning, and connections were developed initially, whereas the category of strategy was added through discussion and evaluation to represent game-play components that were apparent within the game itself that some-

Table 2
Themes That Emerge from Analysis of Design Documents

Themes	Frequency (N=27)	Percentage
Curriculum goals as game objectives	27	100
Visual appeal and feedback	12	44.44
Scaffolding with supporting materials	11	40.74
Rewards-based	10	37.04
Create a sense of accomplishment	10	37.04
Project or customize player identity	9	33.33

Table 3
Prevalence of Subject Areas in Design Documents

General Subject	Frequency (N=27)	Percentage
Mathematics	7	25.93%
Science (Biology and Chemistry)	6	22.22%
Social Studies	5	18.52%
Language Arts	3	11.11%
Life Skills (Health/CALM/AMA)	3	11.11%
Teacher Training Courses	2	7.41%
Music	1	3.70%

times required the use of strategy beyond traditional educational problems. In order to fairly evaluate a game despite the technical limitations of the teachers, the categories of engagement/motivation, participation, and user friendly/ease of play were added to eliminate unfair penalization of a game due to poor game building.

The areas of collaboration, assessment, and scaffolding were decided upon as we concurred that practicing teachers would potentially lean towards emulating a lesson plan in their design considerations. The ranking system was developed over time to ensure that games that asked the same type of question many times were not given a higher ranking over a game that asked one or two very rich questions.

Each category was given a ranking of either "met expectations", "exceeded expectations" or "below expectations", discussed in the Analysis section.

ANALYSIS

Both qualitative and quantitative analyses were conducted to answer the research questions.

To answer the first research question, we first open coded the design documents to identify salient and recurring themes. The themes were developed independently, working from actual themes that emerged from the design documents themselves. The design considerations were collected through the teachers' rationale for game design, which was inspected for similarities that emerged in the documentation. We systematically recorded the themes that emerged from the documents and tabulating the frequency of occurrence. The six most prevalent themes were extracted and analysed.

The second research question was answered by applying the rubric to both the design documents and the digital games. To eliminate a bias, we did not apply a rubric to a game of which the design document had been previously perused by the same researcher, and vice-versa for the use of the rubric on design document analysis. Each of us evaluated 6 games independently before mutually coming to a collective assessment. We discussed our expectations prior to the application of the rubric and came to the conclusion that we expected the digital games to rank lower than the design documents as teachers are more knowledgeable in the pedagogy and curriculum of the educational content that would be stated outright in their intentions versus the actual representation of it within the digital game. Teachers are also not expert game designers, so we expected the games to be technically substandard in conveying the teachers' design intentions than the design documents themselves.

The results of the rubric were analysed by giving each category a number for ranking purposes: 1 for "below ex-

pectations", 2 for "met expectations", and 3 for "exceeded expectations". The total score for the game (out of 33) was obtained by summing up the ratings of each category (11 categories in total). The categories in the rubric are defined in Appendix 1, where we have outlined precise expectations we have of the number of problems and events that need to exist to be considered a fair representation of a standard game. We discussed the abundance of several types of problems and a variety of events that occurred under each category to be going above and beyond a regular game and thus it would be ranked as having exceeded our expectations. We equate this displaying of problems and events in the design document and subsequently in the digital games to the rich problems and opportunities presented in a classroom by a teacher who orchestrates the administering of lessons and practicing of concepts.

The games were then analyzed through descriptive statistics on the results by looking at the rankings for each of the categories. Analysis was done to determine if any patterns emerged. In particular, the rubrics were examined to see if more than half of the games extensively, fairly or minimally represented specific categories. As the data were non-ordinal, the median was the measure of centre and was used for analysis, while no measures of variation were applied.

RESULTS

DESIGN CONSIDERATIONS

The first research question explored design consideration when practicing teachers create their digital games. Twenty-seven design documents were evaluated through detailed perusal where six themes were identified. The themes that emerged, in order of most prevalent to least prevalent are: (A) curriculum goals (B) visual appeal and feedback; (C) scaffolding with supporting materials; (D) accomplishment of gamer; and (E) gamer identity.

It is interesting to note that when faced with an open-ended design template, pedagogy embedded in curriculum goals from existing curriculum mandates such as the provincial Program of Studies and the Canadian Language Benchmark guidelines were in the forefront for design considerations and was uniformly employed by all the practicing teachers within their documents.

The prevalence of rewarding the gamer through the accumulation of success indicators was the same as creating a sense of accomplishment through achievement factors.

The final theme to emerge was the relevance of the gamers' virtual identity factoring in gameplay. One-third of the teachers felt identity was critical to address, pave, and empower gamers' view of themselves in relation to the content presented in the game. Table 2 provides the frequencies and percentages of each theme occurred in the design documents. These themes are explored in detail below.

A. CURRICULUM GOALS AS GAME OBJECTIVES

The most important message that Table 3 exhibits is the provisional need practicing teachers had to include curricular objectives into their game design. Regardless of general subject, all documents also incorporated elements and objectives from other subject areas. Although there was overlap in the categories, the predominant subject was determined by reading the teachers' intentions from their design documents.

For example, text reading (which was intentionally or unintentionally stated as being present due to Language Arts curriculum goals) was present in many games although the focus was on components from other subject areas (e.g. mathematics, science, social studies):

- Game IC used mathematics and science puzzle questions in tandem with extensive text-reading as the game play format
- Game S incorporated reading large texts that defined concepts about East Indian culture

Some teachers merged principles of economics with their intended subject areas:

- Game PS combined office management with good economics and industry knowledge as the game's objectives and tools needed to win
- Game AL combined economics and management skills with the pursuit of aquarium knowledge.

Another salient theme emerged: all games integrated different subjects rather than focusing on any single discipline. Many teachers, who were accustomed to teaching in one subject area, explicitly included the curriculum goals from other subjects. This integration required the teachers to research and outline categories from beyond their expertise. It is yet undetermined to what degree teachers had to accumulate information for these categories but it is evident in at least five design documents that several objectives from a variety of subject areas were included.

B. VISUAL APPEAL AND FEEDBACK

Twelve out of twenty-seven documents incorporated the use of sounds and animations to provide an enhanced visual and contextual experience for the gamer. Some teachers thought that sounds and animations served as feedback and a form of assessment that the gamer could use to move through gameplay:

- Game BZ is a game involving a natural-disaster situation of a blizzard. To create mood and context, "the combination of sound and animation provides the players with instant feedback on their progress and the moving decisions that they make"
- Game LC (a mathematics computing game in a

grocery store setting) includes "animated characters and settings with bright colors and 'cartoony' life-like elements [to] attract the player's attention,...[while]...pleasant songs are used throughout the game as background music to make customers happy".

In addition, to provide feedback, some teachers used sounds and animations to serve an aesthetic purpose that kept the gamer aware of his/her progress and fostered investment which was intended to engage the gamer:

- Game TV invested time in manufacturing digitized versions of hand-drawn images and background sets that had a "look and feel reminiscent of a dark and gritty graphic novel [while]...the audio consisted of sombre background music and voice-over narration at certain points"

C. SCAFFOLDING THROUGH SUPPORT MATERIALS

Eleven out of twenty-seven documents professed the need to scaffold the content presented within the game through support materials in the classroom. Some documents paired the game with the intention of the educator first introducing the topic in class and progressing through the unit prior to classroom implementation of the game. In other words, the game was not stand-alone, but needed context before and/or after the actual gameplay. Two teachers planned their games to be used as part of a classroom exercise:

- Game SF could potentially be used as "pre and post activities where students discuss or document their experience during each level...and the game replayed to further reinforce the various needs of each age level"

Some teachers felt that their games could be played prior to starting an activity in order to activate background knowledge and lay the foundation for the topic:

- Game TV professed that "educational facilitators could use this game to get students interested in the vein of gaining historical knowledge or as a springboard into a more serious academic lesson"

Although there were several different methods teachers could utilise in their games in conjunction with in-class support, the most prevalent methods were to activate prior knowledge, assess game players' on-going skill development, and generate interest in the topic.

D. CREATE A SENSE OF ACCOMPLISHMENT

Many teachers believed the importance of creating an internal sense of accomplishment for the gamers, although they had different methods to accommodate such feelings of accomplishment. Some teachers presented different types of problems. For example, game KJ presented several types of problems with different degrees of difficulty so that "players have the freedom to skip a type of puzzle they have already mastered and go to another type of puzzle they need to practice."

Others offered several levels and options ranging in difficulty that the gamer could use to challenge themselves:

- Game FDL considered gauging a sense of accomplishment "the classic way [by making] the player care about the goal of the game, and then make it hard to achieve" and by monitoring how the player felt in regards to the challenge the game presented which could be "neither too hard nor too easy at any point"
- Game GC provided the gamer with "level and difficulty options [that] customizes [the] challenge for each player...Players have the option of increasing or decreasing the difficulty level...as each stage gets progressively more difficult than the last" which allowed the gamer to set his/her own challenges, thereby being able to achieve them.

It was evident that this affective concept was necessary for gamers to progress through the game. A few teachers changed the rules of play in the game in order to enable players to achieve a sense of accomplishment.

E. GAMER IDENTITY

Another significant design consideration when teachers designed their games was how to enable gamers to project or customize their identity in the game. Identity customization was explicitly addressed in nine of the twenty-seven design documents. Some teachers created a character or an avatar that the gamer could assume and customize throughout the game:

- Game EM used "a generic farmer at the beginning that sets the stage for the development of their virtual identities and they will relate this virtual character to their real-life identities of individuals learning mathematics in a classroom through a game format"
- Game M provided different characters for the gamer to play because role-play "forces [gamers] to process information according to the design of the game and make rational decisions to comply within the games context" Some teachers felt that the gamers could use their games to assume an alternate version of their real-life identities while others felt that gamers could reflect on and analyze their virtual selves as they progressed through the game:

In summary, all teachers presented several curriculum goals from at least one subject area, although many games showcased myriad objectives from more than one subject area in support of the primary objectives of the game. Teachers also stated other important criteria that needed to be met in order for the gamers (the audience most probably being their current or prospective students) to have an enriching experience within the game from which some similarities emerged. Teachers felt that sounds and animations needed to set an aesthetic foundation which would also serve as grounds for feedback throughout the game. External rewards were meant to create incentives and incite competition, while such features as rich problems and level customization generated an internal and intimate sense of accomplishment for the gamer. Teachers also agreed that gamer identity played a big part in how the gamer would form relationships with the characters and objectives of the game and how inversely the gamer may project his/her unique identity on his/her own learning as the game progressed.

PEDAGOGICAL CONSIDERATIONS

The second research question examined the extent to which different pedagogical components were incorporated in the design and building of the games. Table 4 summarizes the median rank of the design documents and digital games in each category (refer to Methods for development and rankings).

Focusing on the design documents, with the exception of the strategy category, more than half of the design documents achieved a ranking where they fairly or substantially represented every category. The median statistic indicated that more than half the documents extensively represented (ranking of 3) the categories of problem-solving, connections, participation, engagement and motivation, and user friendly and ease of play. Looking at the total rank (see Appendix 2), a minimum of 18 design documents achieved extensive representation ranking (3) within each of these categories.

When moved to the semi-developed games, majority of games were fairly represented in the categories supplied by the rubric. Of the total ranks, at least thirteen digital games (out of twenty-four) achieved a ranking of fair or extensive representation in eight of eleven categories of problem-solving, active learning, exploration and reasoning, connections, participation, engagement and motivation, user friendly and ease of play, and assessment (see Appendix 2).

DISCUSSION

This study explores practicing teachers' experiences and thinking of design and building digital games for educational purposes.

Although all of the game designers are practicing teachers and are following the guidelines of curriculum inclusion within their design document as presented by the professor for the graduate course, they are free to include objectives from any curriculum, however represented, in

Table 4
Summary of Pedagogical Rubrics for Design Documents and Digital Games

Category	Median for Design Document	Median for Digital Games
Problem solving	3	2
Active learning	2	2
Exploration and Reasoning	2	2
Connections	3	2
Strategy	1	1
Participation	3	2
Engagement/motivation	3	2
User friendly and ease of play	3	2
Collaborations	2	1
Scaffolding	2	1
Assessment	2	2

***LEGEND:**
BELOW EXPECTATIONS
MET EXPECTATION S
EXCEEDED EXPECTATIONS

whatever format they feel is effective. In this respect, teachers are given the same freedom in lesson planning as is given in the traditional classroom and with any curriculum as a map or guide to this plan. The only difference here is that the teacher has a higher degree of control over the curriculum concepts presented within the proposed game and are required to present a rationale for the genesis of said curriculum. Often, in a traditional classroom, teachers may focus on one or a few curricular objectives at a time, whether it is the format of the lesson presented, the layout of the textbook that is used or the pedagogical beliefs of the teacher, curriculum or school.

It is important to note that many subject areas were incorporated, such as mathematics, science, social studies and language arts, sometimes all within one game. This suggests that during the design process, teachers have the potential and the inclination to connect from and integrate with different subject areas. The inclusion of many subject areas, curricular objectives and learning concepts are exemplified and confirmed by these teachers as they laid out their intentions in their design documents and proceeded to program them into their games. It is possible that teachers believe games can easily incorporate different subjects in teaching. A gaming platform is not linear through the sheer multi-dimensional design considerations required. Many games work on a sensory level as well as an on a cerebral one. Strategy and problem-solving are almost always present in some capacity in games, whether they are digital or not. Teachers incorporate games in classrooms to allow for better retention of concepts learned and give students the chance to assess and evaluate themselves. Digital games have the potential to include many events such as contextual learning with aesthetic and sensory stimulation as well as multi level access to numerous subject areas. Regardless, this study has the potential to show a new perspective to lesson delivery and experiential learning. This may result in changing teachers' pedagogical beliefs later to push them to consider an interdisciplinary approach in the future, with or without games. The building of digital games can compel practicing teachers to learn more about their students' (provided their students are the probable gamers) academic lives, in that the teacher can integrate other topics currently being learned or planned by teachers in other subject areas to create a more comprehensive and connected digital environment from which to learn. Thus, the learning -by-game-building approach has the potential to create a project for more than one practicing teacher to provide expert input from their subject areas, allow the possible collaboration of many teachers to mind the academic welfare of their shared students, provide needed global context for

Table 5
Frequency of Change in Ratings for Categories between Design Documents and Digital Games

Category	Dropped by 2 (-2)	Dropped by 1 (-1)	Stayed the same (0)	Increased by 1 (+1)	Increased by 2(+2)
Problem solving	4	10	8	2	0
Active learning	0	5	7	10	1
Exploration and reasoning	0	6	10	8	0
Connections	2	18	4	0	0
Strategy	1	5	14	3	1
Participation	4	9	10	1	0
Engagement/motivation	2	10	8	4	0
User friendly and ease of play	2	14	7	1	0
Collaborations	6	11	7	0	0
Scaffolding	3	10	11	0	0
Assessments	1	7	13	3	0

individual subjects to shine through and in turn foster a more socially and academically-conscious group of students and teachers. This study creates a platform for practicing teachers to integrate several subjects, curricular objectives and pedagogical approaches and a real benefit of our approach is that it may promote teachers' rethinking about pedagogy and pave a more interdisciplinary approach to their lessons.

Another consideration here is that many teachers have limited experience with programming and gaming. Although a few were avid gamers themselves, almost none of the teachers had any coding or game-designing experience, let alone the aptitude or propensity to master all technical aspects of the gaming software within the allotted time of this study. As was evidenced in the high rankings of the design documents, teachers already have content knowledge as some have acute expertise in certain subject areas. Technology was one of the areas of this study that a few of the teachers were apprehensive of, but what is evidenced is that teachers are able to master several skills within the gaming software of their choice to generate a good enough game that at the very least gave a fair representative score on the rubric. However, Koehler & Mishra (2005) have suggested that although knowledge of technology is important for teachers in today's classrooms, it is what teachers can do with technology that is specifically important to them, as teachers, in the conveyance of content knowledge. Technology, in this respect, is the use of digital games, whereby the teacher is the designer. This puts forward the possibility that the game-design approach may be able to create a contextual platform for learning. The game-building mechanism may be a great platform for cross-curricular embedding and may open the possibility of merging several concepts into one location: the game itself.

As is evidenced from the design considerations, many teachers consider their audience's needs first and foremost over their own preference. This translates to the possibility that teachers as designers may also be catering to the gaming audience as is the gaming industry while marrying the concepts of pedagogy with effectual gameplay. What this tells us is that student engagement is a priority for teachers, whether it is working out problems in a classroom or navigating a level in a digital game. Motivation is also a very important factor for teachers to consider in their design. This is reflected by the recurrent themes of rewards, sound and visual feedback, accomplishment factors (different difficulty levels present the option to choose optimal states of concentration and absorption which helps to strike a balance between the complexity of the task and the abilities of the gamer, as is proposed by Flow Theory from Csíkszentmihályi, 1997), and even the identity (allow learners to take ownership of their learning).

Engagement can also be marked by the relationship gamers have with their digital representations of themselves (e.g. avatars, assumed characters, sole protagonists, sprites, etc.). This theme is complex in itself. One third of the design documents mentioned the idea of virtual identities and the concept of the gamer projecting him/herself into the gaming environment via an avatar or through interaction with non-player characters. Gee (2004) has posited that a relationship exists between the gamer as him/herself and the gamer as the character or avatar. He has asserted that this type of projection creates a bridge between their in-class learning with the virtual learning environment presented in the game. The gamer, having to work through the character, would have to bridge his/her current knowledge within this navigable learning environment.

In current mainstream games, sounds and animations can be a dimension that sometimes guides the success of the game; therefore it is not surprising that almost half of the teachers included this design consideration into their plans for their built games. Although many other teachers did not mention this design element in their documents, presence of sound and work on animation was evident in all games, thus putting forth the idea that it is either an underlying concept that was not addressed by all the teachers or that it was too obvious to include in their rationalization.

The fact practicing teachers are factoring in engagement and motivation by providing avenues for the gamer to connect with the objectives of the game demonstrates the potential of the game-designing environment to focus entirely on the gamer's (and subsequently the students') learning needs. The potential benefits of design have been proposed by many researchers as it creates a level of sup-

Table 6
Summary of Total Scores for Design Documents and Digital Games

Statistic	Design Document	Digital Games
Count	27	24
Mean	25.74	20.42
Median	25	20
Mode	23	23
Minimum	20	11
Maximum	32	29

port, creation, collaboration, and knowledge production (Papert, 1991; Burdick & Willis, 2010; Gee, 2007; Tiong & Yong, 2008). It has been argued by Shaffer, Squire, Halverson & Gee (2004) that the power and attraction of video games need to be harnessed in such a way that they are "personally meaningful, experiential, social, and epistemological all at the same time" in order to create rich contexts for gamers to align themselves, interact with and take risks with the educational concepts of the game, instead of being fed the answers, as can be a pitfall in traditional classrooms and poorly constructed or sensational commercial-off-the-shelf (COTS) video games. It is interesting to note that in our study, the practicing teachers intentionally and unintentionally worked towards motivating the gamer in truly trying to relate and learn from the game itself while becoming more aware of the gamer's needs and by pulling from many different subject areas to create coherent, relevant and global platforms for learning.

In respect to teachers' design documents, they opt to include a variety of theories, rationales, design elements and gaming components. Some interesting observations were prevalent that gave some insight into practicing teachers' pedagogical focus and learning objectives for their students through the game-designing process and subsequently evidenced in the games themselves. Therefore, the concession of using supporting materials and the intention to integrate the game into a larger unit are representative of the planning skills that teachers call upon during lesson preparations. Contextualizing content objectives with daily lesson goals is a key aspect in connecting ideas learned from previous classes with future lessons. It is reasonable to have this aspect integrated within the design documents and games.

Although practising teachers had varying experience with technology, on average, elements from design documents transferred well into the digital format. Overall, almost every digital game met our expectations from the rubric categories regardless of whether or not the corresponding design document met or exceeded our expectations of the same rubric categories. These results suggest that design thinking may transfer into a digital game that closely resembles the practicing teachers' intentions. If sound content and pedagogical knowledge is infused into the design, it is possible that the design may prelude to a sound educational game. This is consistent with the previous research conducted by Koehler & Mishra (2005) and Becker (2007). COTS games are often criticized as not containing sufficient or sound educational elements that could satisfy all, if not, some curricular checklists of classrooms. Digital games built by practicing teachers may possibly be a start to addressing the curricular content needed (which teachers are the primary experts) while packaging it in a language (the digital dialect) and technological environment for which students are already developing skills and fast relationships. The future of digital educational games may lie in a collaboration of curricular design by teachers and input and trials by students as we are moving further more towards a participatory culture, inciting knowledge creation and co-authoring amongst many invested groups.

CONCLUSION

This study provides an enactivist approach to cultivate 21st century skills among practicing teachers. Through learning-by-game-building, practicing teachers are able to build a game that best aligns with the curriculum and interact with their students via the advanced digital language that the students communicate as suggested by Prensky (2001). Thirty-two practicing teachers participated in the study, yielding 27 design documents and 24 games that were analyzed. The results were favourable and suggest that further study of learning-by-game-building among practicing teachers is warranted.

Although it was expected that the teachers' intentions would embody sound pedagogical knowledge of the curriculum and therefore be rationalized within their documents, it was found that practicing teachers exceeded expectations of the rubric categories in the creation of design documents prior to building their games. The documents outlined important themes such as including curricular objectives from several subject areas and competencies; providing in-class support for these games; adding feedback and aesthetic mechanisms such as sounds and good animation; drawing attention to rewarding the gamer; creating a sense of accomplishment and addressing the relationship the gamer has with his/her virtual self. Practicing teachers thoroughly addressed many important needs of their students and took these needs into consideration when designing their proposed games. We also found that these components, as well as overall design intentions, transferred reasonably well to their built games. The games themselves met expectations in almost every category considered.

The results of this study suggest that practicing teachers as designers are fairly successful at integrating educational components to the planning stages of the design process. They can address the necessary pedagogical considerations and propose a design to integrate these learning goals into a digital game. Successful integration of content and curriculum objectives into a digital format create the possibility of presenting relevant learning opportunities in the students' preferred format for today's technologically-savvy "digital native" (Prensky, 2001). Students may be able to extend, practice and negotiate 21st century skills within a contextual digital environment with an experienced teacher facilitating, as needed, through the digital curricular landscape.

Some researchers have proposed that teachers should experience the use of technology in education (Becker, 2007; Prensky, 2001) and integrate content knowledge through technological means (Koehler & Mishra, 2005; Kali & Hoadley, 2008), from this study it has been pronounced that teachers' design intentions are born from experienced pedagogical awareness and become the blueprint

for successful transference to the digital game itself. Inherently, teachers are experiencing and learning 21st century skills by "doing", and informing their practices with sound pedagogical concepts from their own experiences, thus embodying the enactivist perspective of learning. In this study, practicing teachers have been working alone or in very small groups to design curricular content for a digital game. A further study of collaboration between teachers is warranted as we have witnessed that teachers bring their expertise in certain subject areas and borrow from others to create context for their gamers. The next step would be to bring together a team of teachers, each an expert in a subject area taught in schools (e.g. math, science, language arts, social studies, etc.) and together design a digital game whereby integration of all subjects is essential for knowledge co-creation.

The future of this study lies in the games themselves being tested by the audience that they are intended for to confirm or dispel some of the intentions outlined in teachers' design documents. If it is possible for teachers to learn 21st century skills through the designing and then the successful building of digital games, can it be possible for the students who play these games to attain the concepts inherently built into the games (intentionally and unintentionally by the teachers), together activating previous background knowledge gathered from past subject studies and previous game-playing or other technological experiences? In what ways are the students achieving the curriculum objectives and are these the most effective ways to obtain these concepts?

A further question then develops: How well would the digital games, adapted closely from these design documents, fare when played by real gamers? Future studies would need to incorporate treatments groups that played one of these games versus the control groups that took traditional classes within the subject area represented in the game played by the treatment group. For example Game MG is about Ancient Greek culture – a topic taught in a Social Studies class. This future research area could show some real evidence to subject-oriented learning outcomes within a digital game format as being another effective way of learning. Further studies are suggested in order to determine if teacher awareness of the elements of sound and animations during the initial design documenting process can affect the quality of the games. Gamers could also be surveyed to see if sounds and animations indeed offer effective feedback and visual appeal. The concepts gamers learn through creating relationships through their character and how effective the game is in fostering these relationships could also be possible future studies for our research.

Limitations of this research include the sample size of our participants (32) and limits imposed from the technology platforms that were used. Another limitation was that the games were analysed by the researchers alone, and in the future, we would also like them to be evaluated by the intended audience. For the future, we would like to increase our sample size and integrate long-term focus-testing allowing practicing teachers to work directly with their audience to iteratively produce a mutually successful digital game.

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APPENDIX 1:
Rubric for Evaluating Educational Value of Digital Game Design Documents by Teachers

Category	Below Expectations	Met Expectations	Exceeded Expectations
Problem solving	No events or one small event that showed problem solving.	One substantial event, or two or three distinct small events that showed problem solving.	More than one substantial event, or more than three distinct small events that showed problem solving.
Active learning	No events or one small event that allowed for active learning.	One substantial event, or two or three distinct small events that allowed for active learning.	More than one substantial event, or more than three distinct small events that allowed for active learning.
Exploration and Reasoning	No events that allowed for exploration and reasoning.	One substantial event, or two or three distinct small events that allowed for exploration and reasoning	More than one substantial event, or more than three distinct small events that allowed for exploration and reasoning.
Connections	No events or one small event that showed connections.	One substantial event, or two or three distinct small events that showed connections.	More than one substantial event, or more than three distinct small events that showed connections.
Strategy	No events or one small event that showed strategy.	One substantial event, or two or three distinct small events that showed strategy.	More than one substantial event, or more than three distinct small events that showed strategy.
Participation	Does not encourage most players to participate.	Encourages most players to participate.	Encourages all players to participate.
Engagement/ Motivation	The game is not interesting or fun to play.	The game is interesting and fun to play.	The game is really interesting and really fun to play.
User friendly and ease of play	Confusing or unclear objectives or instructions. Many elements that caused major frustration in play and may cause player to stop playing.	Clear objectives and instructions of the game. A few elements that cause minor frustration in play.	Very clear objectives and instructions of the game. No elements that cause frustration.
Collaborations	The game doesn't allow any form of collaborations with other players or with other objects in the game.	The game allows for some collaboration.	The game encourages several collaborations, whether it is with non-player characters or with other gamers.
Scaffolding	No scaffolding occurs within the game. There is no support for progression of knowledge or concepts in the game.	The game creates an adequate platform for scaffolding through tutorials or guides.	The game goes above and beyond in setting up stages and levels that progress the concepts conveyed in an increasingly challenging way.
Assessment	The game has no characteristics that help the gamer to assess their level or situation within the game. Gamer may feel lost when trying to understand his/ her abilities and/or achievement in the game.	The game provides tools (e.g. hit points, level ups, gauges/ meters, visual maps, messages and alerts) to adequately assess the gamers progression through the game.	The game is set up in a way that makes the gamer feel as though he/she knows how his/ her character is doing, what levels have been achieved or need to be, and is able to make conjectures on the gameplay because of it.

DEFINITIONS OF CATEGORIES:

This rubric is designed to see if a game was created that promotes good teaching and good learning. That is, the game isn't just a digital worksheet. Instead the game promotes inquiry, critical thinking, and exploration. The categories chosen for this rubric are areas that the researcher believes are important components to good educational game design. In no way would we suggest that these categories are mutually exclusive. Instead we would suggest that the categories are all intimately related to each other.

The first five categories focus on the educational component of the games. While the remaining categories focus on game design and enjoyment of the game.

PROBLEM SOLVING:

From the National Council of Teachers of Mathematics (NCTM, 2000), problem solving "means engaging in a task for which the solution method is not known in advance. In order to find a solution, students must draw on their knowledge, and through this process, they will often develop new develop new mathematical understanding" (p.52). The game should encourage students to "build new mathematical knowledge through problem solving; solve problems that arise in mathematics and in other contexts; apply and adapt a variety of appropriate strategies to solve problems."

ACTIVE LEARNING:

Here we are looking for components of the game that make a student think about what they are doing. As a negative definition, inactive learning occurs when a student is just given a simple question and is asked to answer it. Instead active learning occurs when students develop their own questions and/or are presented with a complex enough question that multiple steps are required to answer it (and these steps are not laid out for the student). Players may have to think outside of the game. The mathematics is not necessarily explicit.

EXPLORATION AND REASONING:

Rich problems allow for students to explore and discover the solution rather than solving it by straightforward computations. They allow for students to "make and investigate mathematical conjectures" (NCTM, 2000, p.56) and to look for and identify patterns and structures. Here we are looking for problems that allow students to further their understanding of the topic by delving into the problem and justifying their solution.

CONNECTIONS:

Here we are looking for components of the game that relate the material to:

- different areas in mathematics (e.g. if the game is specifically examining fractions, then if the game also examines linear functions, this would be an example of a connection to a different area in mathematics);
- or different subject areas (e.g. the game includes components related to physics or biology);
- or real world experiences that the students whom the game is targeted at would be knowledgeable of and experience in their own lives (e.g. relating percents to GST).

STRATEGY:

Within the game do players have to strategize to arrive at the end? That is, there are elements of the game that require the player to make a plan so that they can accomplish a component of game play. For example, in the Portal games you have to plan where you are going to put your portals so that you can finish a level. This category focuses on game play.

PARTICIPATION:

A game is well designed if both strong and weak students want to play it. The educational components of the game are set up in a way that does not exclude weak students or bore strong students. That is, the problems are rich enough to allow students of all levels the opportunity to attempt the problems. This category focuses on the problems posed.

ENGAGEMENT/MOTIVATION:

A big reason for using games in schools is because they are fun and students like them. We want the students to enjoy what they are doing and be engaged in the experience. This is a very difficult category to quantify as it is fairly subjective. Here we would be looking for game elements that would interest students. Examples of components that could be considered engaging and motivating include (but are not limited to) an interesting narrative, working towards a goal, competition (with self or others), and increasing level of difficult. This category focuses on game play.

USER-FRIENDLY AND EASE OF PLAY:

A large component of good game design is making sure that the objectives and instructions of the game are clear. If not, this can effect engagement and participation. Here we are looking at whether the game was frustrating or not. Did you understand what you were your goals and objectives were? If you were told to accomplish a task, were clear instructions given on how that could be done? Is the level of the game play at a reasonable level?

COLLABORATIONS:

The game shows avenues for the gamer to work with other gamers or with objects and/or non-player characters within the game, for the purpose of emulating group work, connecting to the environment and sharing knowledge with other gamers. Teachers include this component into daily

lessons and so we expect it to be present in some form within the design of the game. There is debate over how to rate "collaborative learning" and the different settings in which collaboration can occur, therefore Dillenbourg (1999) narrows the parameters of this category as knowledge being transferred "between two or a few human or artificial agents for a well-defined learning or problem solving task" (p.4).

SCAFFOLDING:

For a teacher, the primary reasons for staggering lessons is to build on previously taught concepts, always increasing the level of challenge and the conveying of knowledge in good measure, in order to stay within the knowledge competencies of their students but always pushing the boundaries of their learning (Vygotsky, 1978).

ASSESSMENT:

We define assessment here as components of the game that allow the gamer to reflect on his/her progress thus far and gauge the skills employed in the game up to that point. This category is very close to scaffolding. Although elements are built in to teach past concepts in scaffolding, this category of assessment defines a more explicit mechanism for the gamer to be able to understand his/her own progress. The assumption is that the gamer will use this self-reflection to build upon their own knowledge and utilize the skills he/she has developed or employed within the game for more complex questions or intricate elements further along in the game.

DEFINITIONS FOR RUBRIC:

An event is any component of the game. This can include explicit or implicit problems presented, strategies needed to solve the game, or anything else that is a feature of the game.

Here we will define a substantial event as a component of the game that would either take substantial gameplay time to do (20% to 50% of game time) or as a primary component of the game (e.g. a theme that runs throughout the game but doesn't necessarily take up a lot of gameplay).

Distinct events can include the same type of problem but in different context. For example, if all of the questions are solving real world problems (e.g. applying percentage), but each of the situations are different (e.g. adding GST, determining how much is saved, determining new price), then these would be considered distinct events.

If the game involves solving one very rich problem, we will take that to be more than one substantial event.

APPENDIX 2:

Frequency of Rubric Rankings per Category Applied to Design Documents

Category	Below the standard	Standard	Above standard	Mean	Median	Mode
Problem solving	0	6	21	2.78	3	3
Active learning	13	10	4	1.67	2	1
Exploration and Reasoning	10	9	8	1.93	2	1
Connections	0	1	26	2.96	3	3
Strategy	14	6	7	1.74	1	1
Participation	0	5	22	2.81	3	3
Engagement/motivation	0	9	18	2.67	3	3
User friendly and ease of play	0	7	20	2.74	3	3
Collaborations	7	11	9	2.07	2	2
Scaffolding	4	15	8	2.15	2	2
Assessment	1	19	7	2.22	2	2

Frequency of Rubric Rankings per Category Applied to Digital Games

Category	Below the standard	Standard	Above standard	Mean	Median	Mode
Problem solving	4	13	7	2.13	2	2
Active learning	6	14	4	1.92	2	2
Exploration and Reasoning	4	18	2	1.92	2	2
Connections	2	19	3	2.04	2	2
Strategy	15	4	5	1.58	1	1
Participation	4	13	7	2.13	2	2
Engagement/motivation	3	13	8	2.21	2	2
User friendly and ease of play	5	12	7	2.08	2	2
Collaborations	23	1	0	1.04	1	1
Scaffolding	13	11	0	1.46	1	1
Assessment	5	16	3	1.92	2	2