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Using electronic textbooks to teach mathematics in the secondary classroom: What do the students say?

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ABSTRACT

Textbooks have been used to enhance teaching in mathematics at all levels of schooling for many years. The use of textbooks enables the mathematics content to be presented in a sequenced, coherent and logical way. There are very few studies, however, that explore student thoughts about the use of electronic textbooks (e-texts) in secondary classrooms. This paper reports the results of a study that aimed to develop an understanding of the phenomenon of student experiences of using an e-text during mathematics lessons; specifically those aspects that dominate the experiences and the ways students perceive their relationships amongst themselves and their teacher when using a mathematics e-text. The results of this study suggest that students using the e-text had a very positive experience. The use of e-texts brings a renewed approach to learning by providing students with what they perceive to be a useful, empowering experience.

INTRODUCTION

Textbooks undoubtedly affect what is taught and what students learn (Stein, Remillard & Smith 2007; UNESCO 2016), and have been used to enhance the teaching of mathematics at all levels of schooling for many years. Of course teachers will use textbooks in different ways, but if it is well designed and based on the curriculum, it can offer useful resources to aid educators to design learning (Hill 2010). When used in this way, it has been reported as having a significant impact on teachers' lesson planning (Banilower et al 2013), with the role of the teacher in using the text as being critical in determining how students learn mathematics.

Many teachers rely on quality textbooks and teaching materials to successfully implement national curriculum standards (Polikoff 2012). Textbooks can scaffold a student's learning of essential discipline knowledge by using an organizational structure that is sequential, ordered, coherent, and connective (Chambliss & Calfee 1998; UNESCO 2016). Students draw connections and are guided by the textbook to apply, synthesise and evaluate problems in the discipline (Hill 2010). Traditionally, tools such as learner objectives, embedded questions, examples, solutions, and activities have been used to aid student learning by clarifying discipline concepts (Bryan & Slough 2009). Textbooks are essential learning tools that do the 'heavy lifting' of explaining discipline concepts (Horsley, Knight & Huntly 2010).

"Textbooks mediate the standards-to-practice continuum" (Polikoff 2015, p. 6), driving instruction in spite of the fact that curriculum resources and materials are increasingly available online (Chingos & Whitehurst 2012). Discipline teachers are unlikely to passively use textbooks to drive instruction but out of field teachers may be tempted to use them as the default curriculum (Knight 2015; Remillard 2005). Textbook usage in classrooms ranges from minor use to the de facto curriculum, dependent upon individual teacher's views on teaching and learning and the discipline taught (Slough, Cavlazoglu, Erdogan, Wakefield, & Akgun 2015). Teachers are a diverse cohort and how they use technology, including e-texts, when designing and implementing learning activities varies considerably (O'Reilly, 2016). Knight and Horsley (2013) have described a typology framework (integrated core, core, related resource and peripheral resource) to delineate

the different uses of textbooks by teachers and students. When teaching and learning is solely based on the textbook, it is used as an integrated core to outline the scope, structure, resources and learning activities of the course. Alternatively, when textbooks still perform a significant role but are supplemented by additional material and resources, they have a core role to play. The use of many resources to teach a course, which includes the textbook, sees it being used as a related resource to support students' learning. Lastly, if the textbook is used only to provide contextual background information, their use is regarded as a peripheral resource.

Secondary mathematics courses are usually supported by commercially produced textbooks, including e-texts, with many of them produced for specific courses, thus being used as an integrated key or vital resource. Increasingly, these resources contain pedagogic features to assist learning and specific packages to provide support for teaching.

The digital age represents the liquid information culture of the 21st century (Area & Pessoa 2012), and schools need to respond to the diversity of texts with which students interact (Kress 2003). As ICT is increasingly being incorporated into young people's lives inside and outside of school, Markauskaite and Goodyear (2009, p. 615) assert that students' learning routines now use technologies where "the knowledge, activities, relationships and resources involved in student learning are becoming more fluid, and are entering into more complex combinations." Increasingly, students are engaging and interacting with multiple sources of information using self-selected web tools to support individually determined social networks (Fasso, Knight & Knight 2013). Students and teachers are using a wide range of tools to support structured learning. For example, one-quarter of students in grades 3 to 5 and almost one-third of students in grades 6 to 12 indicated that they are using a mobile device provided by their school to support schoolwork (Project Tomorrow 2014, p.3). This use of ICT has been reported by students as building more favourable attitudes to learning (Cooner 2010; Light & Pierson 2014), enhancing accessibility of interactive resources (McTigue & Slough 2010) and increasing their engagement on learning tasks (Coller & Scott 2009; Light & Pierson 2014).

There are few studies examining students' experiences of using electronic texts to learn mathematics in middle school classrooms (Chesser 2011; Knight, Casey, Dekkers & Thrupp 2015). It has been wrongly assumed that the textbook, even in electronic form is irrelevant in a personalised and networked Education 3.0 world (Knight 2013, 2015; Knight & Horsley 2013). However, textbooks continue to be a key teaching and learning resource for students (Knight 2015; Horsley, Knight & Huntly 2010). In the present research, the researchers sought to develop an understanding of the phenomenon of students' online experiences during mathematics lessons; specifically those aspects that dominate the experiences and the ways students perceive their relationships amongst themselves and their teacher when using a mathematics e-text.

METHOD

This paper reports part of a larger study into student online experiences during mathematics class. The larger study comprised two rounds of data collection being Round 1 interactive online context and Round 2 e-text online context. Results from the use of the Round 2 e-text are being highlighted here. The use of mixed methods methodology in this research enabled the researchers to collect several forms of data that explore the multiple-faceted perspectives of student online experiences during mathematics class. Ethics approval to complete the research was approved by the university ethics committee.

The study took place in an urban state high school with a total population of just over 600 students. The study was a purposive sample of 79 Year 8 students aged 12 to 14 years. The ratio of males to females was 2:1 respectively, reflecting the cohort of students enrolled for that year at

the school. This indicates that all students enrolled at the time of the study were invited to participate. Out of the 104 students enrolled 72 were female and 32 were male. The 79 students comprised those who had returned permission forms. The sample comprised all achievement levels ranging from foundation, core and extension students. A representative subgroup of three girls and three boys were randomly selected for focus groups designed to collect additional data about students' reflections about their online experiences.

The researchers designed data collection instruments to assess students' online experiences, as no instruments were readily available. The 'Student Maths Opinionnaire,' (SMO qual) was created as a qualitative survey of open-ended questions, and (SMO quan) was a survey comprising Likert scale questions. Figure 1 shows sample questions from SMO qual and SMO quan.

Sample SMO (qual)

Student Mathematics Opinions

Please fill in the following question to provide your opinion and feelings about today's lesson in the ISC. Use your own words to finish the following sentences in any way you feel describes your thoughts about the use of computers in a Mathematics lesson. Write down the first thoughts that come to your mind.

1. In my opinion the main purpose of using the online Mathematics textbook is ……

_____

2. When my teacher teaches from the online Mathematics textbook ……..

Sample SMO (quan)

1. I found doing Measurement using the online textbook helped me				
no help	very little	not sure	somewhat helpful	very helpful
2. Compared to face-to face learning with my teacher I found doing Measurement using the online textbook was				
harder	somewhat harder	not sure	somewhat easier	easier

Figure 1. *Sample questions related to e-text from SMO qual and SMO quan*

The data collected in SMO qual was processed using *NVivo10* software for qualitative analysis. Informal coding consisted of creating lists of themes as they emerged within the data collection. The process of considering further additions of data, allowing for a comparison of ideas within and across the data collection sources, were taken in to account. Once no new data was being collected with the data collection instruments, *NVivo* assisted in confirming constructs by cross checking in the data coding process.

In the quantitative analysis of data, the statistics software program *SPSS Statistics* Version 20 was used to undertake descriptive analysis of mean and standard deviation items in SMO quan.

Furthermore, frequency tables showing counts and percentages for Likert scale items and factor analysis were undertaken using *SPSS*.

Focus groups were used to collect data on student reflections about the online experiences as well as conversations between students whilst using online mathematics blogs. In this research the online read-only version of Maths Quest 1 for Queensland, 2003, was used.

Seven key themes were identified in the review of the literature and through the collection of data. Table 1 provides a description of how each theme was relayed by the students in the data collection instruments.

Table 1. *Themes identified and the student description of the theme.*

Themes	Students' Description
Student culture	Many responses indicated students felt the online context was peculiar to young people and that it was their domain more than their teacher's.
Use of differentiation in ICT	Students put forward responses related to the ability to work faster or slower as per their own abilities or of those around them demonstrating the affect of online learning on differentiation amongst learners.
Student empowerment	Students repeatedly used terms such as independence, increase, modernise, develop etc. indicating a sense of empowerment during mathematics lessons utilising computers
Social aspects	Students repeatedly expressed opinions about social aspects such as freedom to communicate amongst themselves and friendliness of their teacher and fun of using computers to learn mathematics.
Teacher-student interaction	Students listed teacher support and promotion for their learning and understanding of mathematics during lessons using computers. Teacher's role, presence and interactions were also described. Students also listed their desire for teacher support and promotion for their learning and understanding of mathematics.
Computer usability	Many students brought forward comments related to use and convenience of going online to do mathematics. For example the speed or lack of speed when logging on or uploading material, the benefit of repetition for RLOs, instant feedback for their answers and convenience of not carrying a textbook around were mentioned.
Visual aspects	Students showed much interest in being able to alter the size of the font, consider the brightness, use of diagrams to show mathematical concepts visually. Some students said they are able to remain focused on the screen more easily and for longer periods of time compared to looking at the same material in the paper copy of the text.

RESULTS

Seven constructs were generated from words and phrases used by student opinions of their e-text experiences. These included student culture; differentiated learning; empowerment; sociability; usefulness; visual aspects; and teacher role. Figure 2 provides a brief description of each construct.

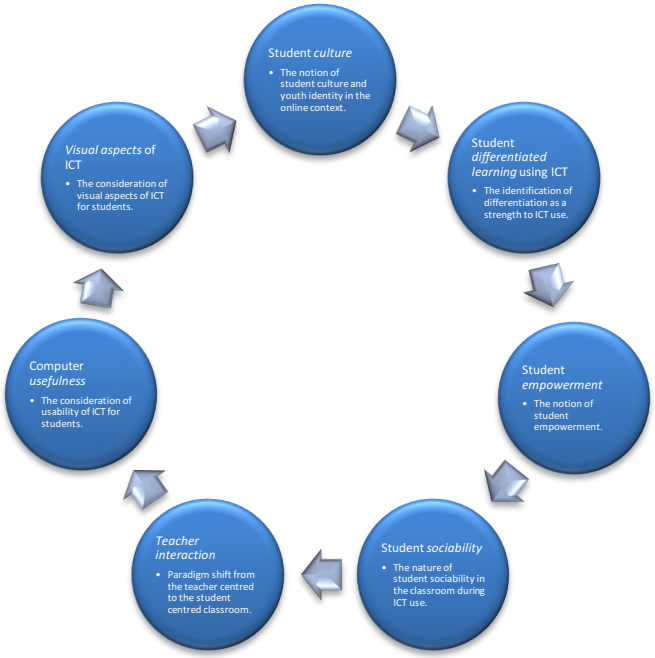

Figure 2: *Overview of constructs describing student perceptions of ICT use during mathematics class*

The constructs as shown above were found to be specific features of student experiences of using computers, as uncovered in the context of this research. Figure 3 presents the ranking position in the data of the seven constructs during the interactive online and e-text use, contexts. The vertical axis represents percentage coding points of the construct within the data.

As can be seen from Figure 2, within the group of constructs there is a distinctive difference between the first two constructs and the remaining five constructs. Specifically, the first two constructs (*usefulness* and *empowerment*) occurred in 56% of the data; that is representing a total 480 out of 730 codes. The most prominent construct referred to by students describing their online experiences during mathematics class using the e-text, was the construct *usefulness*, comprising over 40% of the coded data. This result confirms that students perceived *usefulness* and *empowerment* to be prominent considerations regarding online maths classes using the e-text, a finding supported by Light and Pierson (2014) as students take more control of their learning experiences using technology. Furthermore, Figure 2 shows comparisons between data collection Round 1 Interactive ICT use with Round 2 E-text use revealing the students perceived teacher interaction to an equal degree in both online contexts, whilst sociability increased more than ten fold in the e-text context.

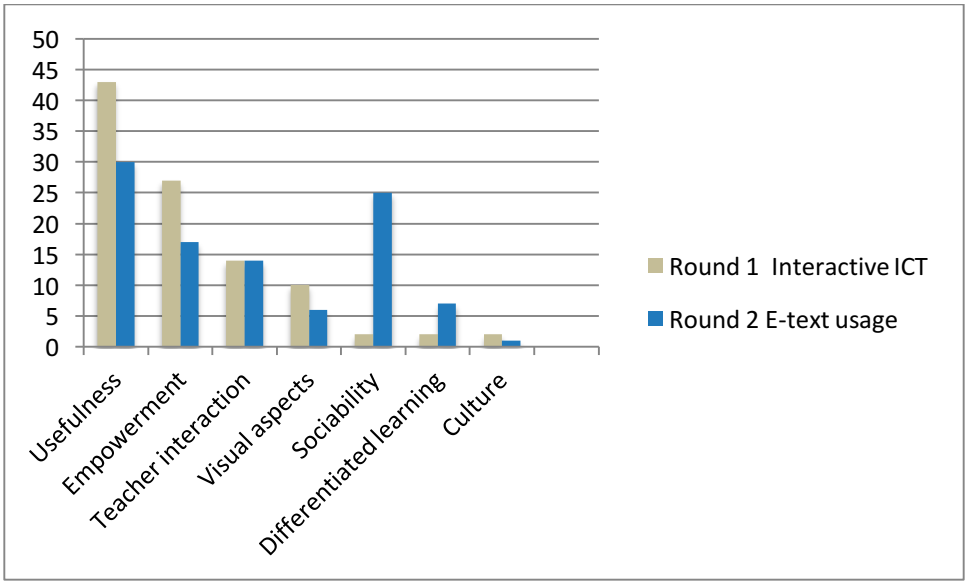

Figure 3: *The relative prominence of constructs in data*

A word frequency search was performed using *NVivo 10* data software to catalogue topics drawing words together that were related by a known topic or to point to new categories. The purpose of this analysis was to sort and identify relative occurrences of words and their relationships in data that might otherwise have been overlooked. *NVivo* provided a computerised means to analyse the data and support the interpretation process by enabling the researchers to start small and build a picture of the coded data (Richards 2010.) Table 2 below identifies the top nine words used by students in the SMO (qual) open-ended surveys, their counts and weighted percentage along with the construct category(s) for the e-text data.

Table 2: *Word frequency use in open- ended surveys*

Word	Count	Weighted Percentage (%)	Construct Category
easier	79	3.02	Usefulness, Empowerment
help	72	2.75	Usefulness, Empowerment, Teacher interaction
needed	40	1.53	Usefulness, Teacher interaction
better	39	1.49	Usefulness,
talking	34	1.30	Empowerment, Sociability, Differentiated learning
teacher	34	1.30	Usefulness, Teacher interaction, Sociability, Differentiated learning
carry	33	1.25	Usefulness
use	30	1.19	Usefulness, Empowerment
zoom	27	1.07	Usefulness

It can be seen in an e-text context, the construct of *teacher interaction* was listed in connection with the words *teacher* and *help* and was also listed in relation to the word *needed*. This result is interesting when compared to studies by Mitraet al (2005) advocating minimally invasive education (MIE). Proponents of minimally invasive education advocate minimal teacher presence and input for students using ICT. Inversely, the results of this study suggest that students felt that '*teacher*,' '*help*' and '*needed*' to be integral to learning using a computer and utilising an e-text. Light and Pierson (2014) suggest that teachers take on new roles when working with technology.

It is noteworthy that Table 2 shows the word *talking* linked with the constructs, *empowerment, sociability,* and differentiated *learning*. It is a widely held view that lessons using ICT are quiet with students facing computers and little interaction amongst themselves or with their teachers. Likewise it may be perceived that the use of paper textbook includes minimal interaction among students or with their teacher. But in this research using the e-text, talking was shown to be prominent in student descriptions of e-text learning during mathematics class. This is important to teachers desiring to initiate more response from students or conversation during mathematics class (Light & Pierson 2014).

Lastly, the construct *usefulness* dominates as a related construct in eight out of the nine most frequently used words by students in the e-text survey data. In accordance with this result reflecting student opinions, lesson plans incorporating e-texts would likely be well received by students.

Word clusters of the frequently used words by students were generated using *NVivo 10* to demonstrate whether frequently used words during the e-text context were related. Figure 4 displays the word frequency query of word clusters in the e-text data.

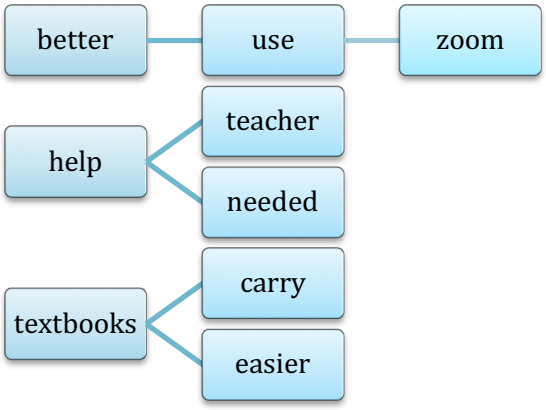

Figure 4: *Word clusters from survey data in an e-text context*

In Figure 4, three related links are shown in the results for an e-text context. The first shows a relationship between the words *better*, *use* and *zoom* with all three words having the construct *usefulness* in common. The second word cluster displays *help, teacher* and *needed* relate to the construct *teacher interaction*. The final word cluster demonstrated that the words carry and easier linked to the word *textbooks*. Textbooks was not in the top nine frequently used words, however, its link to *carry* and *easier* was noted in the word cluster for clarity of the use of those words.

The word clusters reveals specific words, from students own descriptions that assist in understanding why the constructs *usefulness* and *empowerment* dominate in the e-text data. It suggests that students value e-texts as 'better' and 'easier' as well as a 'help' during mathematics class.

The focus group served to further distill the e-text data as the participants considered the results from the aforementioned surveys during the focus group discussion. The top nine words used by students in focus group discussions about the use of e-texts is provided in Table 3.

Table 3: *Word frequency use in the Focus Group e-text context*

Word	Count	Weighted Percentage (%)	Construct Category
textbook	45	2.91	Differentiated learning, Empowerment, Usefulness, Visual aspects,
screen	23	1.48	Differentiated learning, Empowerment, Usefulness, Visual aspects, Teacher interaction,
want	15	1.03	Differentiated learning, Empowerment, Teacher interaction, Usefulness, Visual aspects
using	15	.97	Differentiated learning, Empowerment, Teacher interaction, Usefulness, Visual aspects
better	13	0.84	Differentiated learning, Empowerment, Sociability, Teacher interaction, Usefulness, Visual aspects
easier	12	0.77	Differentiated learning, Empowerment, Usefulness, teacher interaction
get	12	0.77	Empowerment, Teacher interaction, Usefulness
time	12	0.77	Empowerment, Sociability, Usefulness
pace	11	0.71	Usefulness, Teacher interaction

It can be seen in Table 3 that the construct of *differentiated learning* showed prominence in the word frequency query and was linked to the following words: *textbook, screen, want, using, better, and easier*. The construct *visual aspects* was represented in five of the nine words in the word frequency query. The word *time* was shown on the list, linked with the constructs *empowerment, sociability* and *usefulness*.

Visual aspects were described with the computer screen being described to be *better* and *easier* due to brightness of colour and options for adjusting size by using the zoom function. Visual aspects of computer screens were preferable to visual aspects of a paper copy of their textbook. Highlighting the visual aspects of learning mathematics, students described the ability to follow the position of pronumerals in an equation through the use of colour coding, as compared to a paper textbook with only limited colour use. One student when describing the e-text as appearing fresh and bright stated, "It is like having a brand new textbook every time you log on to your computer." Additionally, the claim was made that it is easier and considered "normal" to look at a computer screen for extended time, though the same could not be said of a paper textbook. Table 4 demonstrates contrasting results highlighting the differences in the interactive and the read-only textbook contexts.

Table 4: *Comparison of significant results highlighting the differences in Interactive and Read-only textbook contexts*

Item	Interactive context results	Read- only textbook context results
Using the computer to do mathematics was 'somewhat useful' to 'very useful.'	**67%**	**72%**
Doing mathematics online as a way of learning 'very much suited' or 'mostly suited.'	**43%**	**71%**
Doing mathematics online was 'somewhat relaxed' to 'very relaxed.'	**18%**	**72%**
Doing mathematics online was 'stressful' and 'somewhat stressful.'	**43%**	**<2%**

It can be seen from Table 4 that student responses to the e-text were more positive when compared to the interactive online context. The reasons students preferred using the e-text, over the interactive RLOs and blogs may have been a consequence of student recognition of different levels of *usefulness* of computers and *empowerment* during online mathematics lessons. In addition, the e-text was an exact version of the paper copy textbook already in use by the students and as a result familiarity of their online textbook may have caused students to feel more relaxed. Students provided positive descriptions conveying the *usefulness* of the e-text, highlighting the visual aspects and convenience as opposed to a hard copy textbook. This is consistent with findings reported in the literature. Specifically, the use and role of computers has become completely normalized by this generation. If it is now fully integrated into their daily lives, then students may no doubt expect computer use to be common classroom practice. Literature describing the changing classroom as a result of ICT use, found *empowerment* by students was enhanced during lessons using computers and suggested student centred learning to be a key aspect. In this research, statements by students such as, "We are more in control of our learning," "When you do things independently you get more confidence to do it by yourself." and "We get to learn how we want," highlight student *empowerment, usefulness* and the use of student-centred learning.

Furthermore, students claimed the visual aspects of the e-text enabled better and longer focus, compared to using a paper copy text. Students describe negative perceptions by their peers when staring at a paper copy textbook as opposed to being considered '*normal*' if seen to be wholly focusing on the computer screen for large amounts of time. In light of these findings the use of e-texts may be a positive context for introducing ICT use during mathematics lessons. As has been shown, students would likely welcome electronic copies of their textbooks and the use of e-texts could be given preference over paper-based texts.

Finally, the qualitative results indicated students maintained greater and longer focus using the e-text than would normally be the case with paper textbooks. This was effectively explained by the comment of one student stating, "The screen sucks you in and you stay focused."

The quantitative results included item scores and factor analysis. Item score results for the e-text were particularly positive. Table 5 displays the item score results on a scale of 1-5 for the read-only context of the student e-text.

Table 5: *Item scores (N=61)*

Item		Mean	SD
1. Doing mathematics using the online textbook was	**negative - positive**	4.49	0.66
2. Doing mathematics using the online textbook was	**complicated -simple**	4.41	0.84
3. Doing mathematics using the online textbook was	**confusing - clear**	4.15	1.06
4. Doing mathematics using the online textbook was	**no help - helpful**	4.06	0.98
5. Compared to one-on-one doing mathematics using the online textbook was	**no difference - very different**	3.98	1.19
6. Compared to in class learning doing mathematics using the online textbook was	**harder - easier**	4.13	1.02
7. Reading the questions using the online textbook was	**useless - useful**	4.20	0.86
8. Doing mathematics using the online textbook as a way of learning	**did not suit - very much suited**	4.16	0.93
9. Doing mathematics using the online textbook made me feel	**bored - excited**	4.05	0.92
10. Doing mathematics using the online textbook made me feel	**stressful - relaxed**	4.21	0.68
11. Doing mathematics using the online textbook is designed for	**adults - young**	3.33	1.16
12. Time spent doing mathematics using the online textbook passed	**slowly - quickly**	4.18	0.94
13. Using the online textbook to show my friend how to do mathematics	**never - definitely**	3.84	1.21
14. Using the online textbook affects on learning	**makes no difference - enhances**	3.93	0.95
15. Using the online textbook to do mathematics is	**out dated - modern**	**4.51**	**0.62**
16. Using the online textbook to do mathematics is	**unimportant - important**	4.05	1.16

It can be seen that all items in the e-text context had a mean score above 3.33, which indicates that students responded positively to all items in the survey. The average mean score for the e-text was 4.12. The highest mean was 4.51 scored on Item 15 tending towards ‘modern’ for describing the use of the e-text to do mathematics. Also the lowest SD in all items was item 15 comprising 0.62. This indicates students were highly certain about their response. The SD spread between highest to lowest score in all items was 0.49, suggesting students were highly certain about their responses describing experiences using the e-text during mathematics class.

These results highlight positive student perceptions about e-text use, adding to the case that e-texts are a motivating and engaging way to deliver the curriculum. If students feel that e-texts are very 'modern' and 'important' they will no doubt be more likely to use them, a practice not commonly found for paper textbooks. As one student in this study explained, "Nobody looks at their textbooks for long amounts of time."

Factor analysis

Table 6: *Varimax factor analyses solution for e-text data (4 Factors)*

Item	Scale	F_1	F_2	F_3	F_4
1. Doing mathematics using the online textbook was	**negative - positive**	.73	.33	-	-
2. Doing mathematics using the online textbook was	**complicated - simple**	-	.85	-	-
3. Doing mathematics using the online textbook was	**confusing - clear**	-	-	-	.82
4. Doing mathematics using the online textbook was	**no help - helpful**	.61	.51	-	-
5. Compared to one-on one doing mathematics using the online textbook was	**no difference - very different**	.53	-	.71	-
6. Compared to in class learning, doing mathematics using the online textbook was	**harder - easier**	.45	.68	-	-
7. Reading the questions using the online textbook was	**useless - useful**	.79	-	-	-
8. Doing mathematics using the online textbook as a way of learning	**did not suit - very much suited**	-	.60	-	-
9. Doing mathematics using the online textbook made me feel	**bored - excited**	.58	-	.49	-
10. Doing mathematics using the online textbook made me feel	**stressful - relaxed**	-	51	-	-
11. Doing mathematics using the online textbook is designed for	**adults - young**	-	-.31	.36	.52
12. Time spent doing mathematics using the online textbook passed	**slowly - quickly**	.41	.54	-	-
13. Using the online textbook to show my friend how to do mathematics	**never - definitely**	-	-	.78	-
14. Using the online textbook affects on learning	**makes no difference - enhances**	-	-	.71	-
15. Using the online textbook to do mathematics is	**out dated - modern**	.36	-	-	.52
16. Using the online textbook to do mathematics is	**unimportant - important**	.40	-	.69	-

A description of each factor is provided in Table 7.

Factor analysis was used in this research to identify common variable (groups of items) that explain most of the variances for the variables being examined and thereby reduce the complexity of the data. The factors were named *F_1 Experience; F_2 Comparisons; F_3 Evaluations;* and *F_4 Impact***.** A Varimax procedure was used to refine factor solutions and to reduce the number of variables having high loading or other factors. A Rotated Varimax factor solution of e-text data is presented in Table 6. Only factor loadings greater than 0.3 are shown.

Table 7*: Factor names and descriptions*

Factor name	Descriptor trends
F_1 Experience	Positive, helpful, very different, easier, useful, excited, modern, important
F_2 User suitability	Positive, simple, helpful, easier, very much suited, relaxed, young people, quickly
F_3 Evaluation	Very different, excited, young, quickly, definitely, enhances, important
F_4 Impact	clear, young, modern

Table 6 and Table 7 show $Factor_1$ and $Factor_2$ largely confirm the qualitative results of the research. However, the results shown for $Factor_3$ and $Factor_4$, *Evaluations* and *Impact* respectively provide further clarity of student perceptions of e-text use. Students perceived their experience using the e-text as described in $Factor_3$ to be '*very different*,' '*excited*,' '*young oriented*,' '*time passing quickly*,' '*definitely using e-text to show friends*,' '*enhancing learning*' and '*very important'*. For $Factor_4$ the impact using the e-text was described to be '*clear*,' '*young*' and '*modern*.'

DISCUSSION

The constructs of *usefulness* and *empowerment* were dominant in the qualitative e-text result, with the quantitative findings revealing largely positive attitudes of students to the e-text.

This result provides support to other research demonstrating the potential of ICT to offer opportunities for differentiation among learners (Light & Pierson 2014). According to the focus group discussion, students perceive and value *differentiated learning* for themselves and fellow students to be occurring during the use of an e-text. Students specifically cited varied levels of readiness and use of the e-text including their ability to speed-up or slow down learning.

Student engagement during mathematics class is a primary concern for secondary mathematics teachers. The foregoing results indicate the use of e-texts may bring a much needed motivating and engaging approach to learning by providing students with what they perceive to be a '*very different*' and '*modern*' presentation of the textbook during mathematics class.

The use of e-texts by students as reported by students in mathematics classes in this study boosted their participation in the classes. Students with different levels of engagement will have diverse opinions on the benefits of e-texts (McGowan, Stephen & Bradley 2009). Although the read-only e-text was uni-directional with closed content, the students reported they enjoyed the activity. The students felt empowered, but this could have been due to the novelty of using e-

texts. Similar results have been reported by Sun, Flores & Tanguma 2012 and Light & Pierson 2014.

CONCLUSION

Although the digital age has extended teachers' content and delivery possibilities, textbooks are still extensively used to guide practice (Chingos & Whitehurst 2012; Horsley, Knight & Huntly 2010). The findings of this study suggest that students using the e-text had a very positive experience. However, it cannot be assumed that the mere existence of an e-text book will improve the quality of the teaching/learning experience. How students perceive and use the resources represents the key to utilising the value of the e-text. Despite the widespread growth in practice, concerns continue to be expressed about the extent to which effective use is being made of technology to improve the learning experience of students (Kirkwood & Price 2014, O'Reilly 2016).

The study reported here is limited in a number of ways. Firstly, data was gathered from a small number (79) of participants in the specific discipline of mathematics who reported their personal beliefs and experiences. The student self-reports disclosed little about their behaviours and learning outcomes. Secondly, the participants were part of a sample that volunteered to participate and therefore are not representative of students in mathematics classes. The results do show, however, that the use of the e-text in mathematics did play an important role demonstrating legitimisation and acceptability of disciplinary knowledge and providing direction for students' learning. With current developments and an expected uptake of online course delivery, it will be interesting to see how students and teachers adapt and respond to the use of learning resources to satisfy the demands of knowledge acquisition, creation and management in secondary education. The challenge for authors of e-text books will be to provide reliable, organised content that can be built upon by learners to transform their learning (Knight 2013).

In considering e-learning, both the students' learning experiences and teachers' design are elements of a more complex learning ecology. Design of the learning activity shapes students' ICT use to support deeper learning (Shear, Koh, Patel, Trinidad, Tan & Png, 2014). In reviewing the influence of this way of managing e-learning research, Ellis and Goodyear (2010, p. 27) conclude that:

> 'when teachers do not focus on the development of student understanding, and have poor conceptions of learning technologies, they tend to use e-learning as a way of delivering information … teachers who focus on the development of student understanding and have richer conceptions of learning technologies, not only integrate e-learning into their approach to teaching, but stress the integration of the physical and the virtual'

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