Connecting Generation Z to Technology through the Task-technology Fit Theory

Full Paper

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Abstract. This study investigated how an interactive e-resource could be used to increase student's performance for a specific assignment given. As academics we are struggling to find sources that really talk to generation Z and how they prefer to learn and understand knowledge. The authors wanted to determine if one can create such a resource to increase student performance. This study investigates the usefulness of a self-created e-textbook through the task-technology fit theory lens. A quantitative data analysis was conducted on a group of undergraduate students at an urban university. A significant association between the characteristics of the tasks, and the technology used to perform the specific task was found. A significant association between the students' (generation Z) understanding of the work and improving his/her knowledge as well as the contribution in a team was also determined. Another significant finding is that generation Z relies heavily on their peers for assistance even though literature says their social skills are underdeveloped. This means that as academics, we need to understand the generation Z and how they prefer to study, and then create content and tools for them so that they can indeed broaden their own knowledge and become life-long learners. Higher education institutions should become more learner-centered and not so much teacher-centered.

Keywords: e-Textbook, e-Resource, Interactive Textbook, Generation Z, Millennials, Task-technology Fit Theory.

1 Introduction

Throughout the years, many authors and academics have tried to answer the question, how do students learn [1, 2]?

Already in 1987, Chickering and Gamson [3] wrote a paper entitled "Seven principles for good practice in undergraduate education". They acknowledged that there was

a problem in undergraduate teaching and emphasised the importance of having commitment from faculty members and students. These seven principles are: 1. Encouraging contact between students and faculty members, 2. Developing reciprocity and cooperation among students; 3. Encouraging active learning; 4. Giving prompt feedback; 5. Emphasising time on task; 6. Communicating high expectations; 7. Respecting diverse talents and ways of learning. And even though this was already published in 1987, the same question is still asked, the problem is still real [4].

One of the mechanisms identified to adapt the "Old" education system is technology, a tool in which we can engage more with students as they are exposed to and used to technology from a fairly young age [5]. Steyn, Botha and Mennega [2] said that they are almost "born with a phone in the hand." This might be an extreme thought for some, but is it really? Social media is overwhelmed by photos of newborn babies every day… thus the baby's first "sight", if we may, is mom, dad, and phone for a picture? This is the generation sitting on our campuses today, gone are the millennials, now we are engaging Generation Z [4, 6, 7]. And yet, it is believed that the education system caters for the "old" generation of millennials, and even prior to them, and not necessarily for Generation Z [7], because these students are changing annually. However not a lot of evidence proofs the technology we use on a daily basis can even be used for education and learning as students need to be engaged in the learning process [8]. New students enter our campuses on an annual basis, making adaption of our teaching approaches difficult. Technology is changing so rapidly that one can hardly stay afloat and keep up. Even the "powerful" PowerPoint presentations are outdated [1, 6]. We need to find the best fit technology for the specific task at hand and see how it works and hopefully that it works. Steyn, Botha and Mennega [2], Vikhrova [4], Shatto and Erwin [6] and Monaco and Martin [1] recommend that more visual tools should be explored as this proved to enhance the learning experience and make students more excited about their studies. Visual tools such as YouTube, more infographics, colorful images, to name but a few. Shatto and Erwin [6] goes so far as to say one should limit reading to only show relevant information. How students use the textbook and its features as well as the instructor usage should be investigated to see if there is a possible interaction between the two [9].

This paper explores the notion of a lecturer designed interactive e-resource, some calls it an interactive textbook, and how students used the textbook to perform a specific task at hand by following the task-technology fit theory. For the purpose of this paper, we will talk about an interactive textbook. In the end, the aim is to investigate the usefulness of the resource for the specific module. Thus, this paper propose that there is a positive association between the interactive textbook and the actual task to be performed.

2 Literature Review

2.1 Millennials vs Generation Z

Although many authors differ as to when generation Z was born and who should be included, it seems as if the agreed upon birth date is individuals born from 1995 onwards [6, 7, 10-14]. Monaco and Martin [1]'s study can be seen as "old" as they still

talk about the millennials, but they make a few interesting arguments on how students learn and more specifically their characteristics. They list seven general characteristics, of which most correlate with [3] above. These are: 1. They feel special: "we are all winners just by participating"; 2. They feel sheltered: "baby on board signs", parent-driven schedules, little free-time, thus not much free thought on daily planning (limitation for educators); 3. Team oriented: Less comfortable working alone; 4. Confident and highly optimistic: instant access to information (24/7), modest commitment to homework; 5. Pressured: leading to longing for instant feedback; 6. Strong desire to achieve: Linking with nr.1, expected to achieve; 7. Conventional: respect culture.

However, generation Z looks a bit different, according to Chicca and Shellenbarger [11]. Generation Z is connected and craves a digital world, but their social skills are underdeveloped and they do not feel safe, which is vastly different from millennials. They are more individualistic and have an increased risk of isolation, anxiety and depression. But they also want feedback immediately and conveniently [6]. They are also more accepting of and open-minded about difference [6]. This different picture should be considered by educators as we cannot assume the same character traits of millennials and think we are engaging our students. These changes in the student's mind-sets are forcing higher education institutions to become more learner-centered and not so much teacher-centered. As academics we need to take a step back, out of the so called "limelight" and understand the students entering our gates, and ask them, how they prefer to learn, what they want to see [1] because our education system was never designed with them in mind.

Vikhrova [4] as well as Shatto and Erwin [6] note that as educators, we have to realize that generation Z see their technology and gadgets as integral to their lives and that they actively use technology in all spheres of their lives. Due to this they are also multitaskers, but not the way we think they are. They have the ability to skip quickly between tasks, even if the activities are unrelated to one another. Generation Z wants to learn by observing and practical applications [6], even preferring a more hands-on approach [7]. These students also prefer to learn independently, on their own [7]. They do see peers and educators as valuable resources, but they will engage on their own terms. And lastly, Vikhrova [4] stated that they are clip-thinkers, in other words, they view fragments of images, facts, videos and process these as a whole so that they can form the big picture. It is noted that clip-thinking helps the brain from congestion and thus acts almost as a filter of information.

Seemiller and Grace [7] noted that there are four things campuses can do to engage with generation Z students: 1. Utilize video-based learning; 2. Incorporate intrapersonal learning into class and group work (breaking a bigger project into smaller manageable sections); 3. Offer community engagement opportunities and 4. Connect Generation Z students to internship opportunities. Now even though these are their four approaches to engage more with students, only the first two will be applied in this paper.

2.2 E-Textbooks

One of the key aspects of e-textbooks are the mobility thereof [8] and how one can "carry" more resources around with you. They continue to say that due to these mobile features, educators can create more customized interactive textbooks. This allows the

creator of these textbooks to focus more on the context of delivery. Bikowski and Casal [8] acknowledged that a large amount of research has already gone into textbook design, "little has been done on customised, interactive textbooks designed within a specific content and with specific course outcomes in mind." This paper aims to change this. When investigating student e-textbook affordability, Baek and Monaghan [15] found that the textbook must be of a high quality and must also be easy to use. The interactive textbook designed for this paper, was designed using a tablet look and feel, thus it was familiar to the students, in terms of usability. It also ensured that the design was clean and this could assist in creating a better quality textbook (Fig. 1).

Fig. 1. Textbook design example.

2.3 Exploration of Task-technology Fit Theory

According to Goodhue and Thompson [16] one of the strongest indicator for individuals to use technology is if there is a system/work fit, thus what I want to use the system for will determine whether I will use it. Giving the specific textbook to the students to perform a specific task, is thus the ideal way of applying the task-technology fit theory.

The theory states that a user should willingly use the technology for a specific task or fit with the users in order to state that it was effective [16, 17].

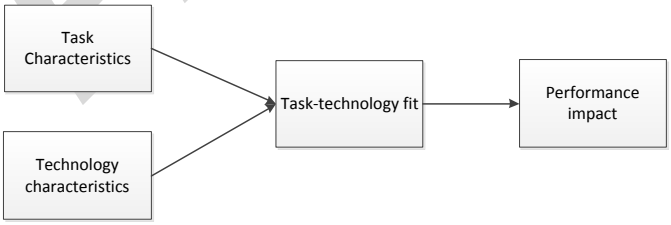

Fig. 2. Task-technology fit theory [16].

The theory was adapted by seeing if students could use a specific technology tool, the interactive-textbook, to improve their knowledge of the subject, apply the various components of the technology to their specific task and if, in the end, they felt it increased

their performance. The purpose of this study was to see if the students found the textbook useful in completing their assignment, thus applying the task-technology fit theory [18, 19].

The task characteristics for this assignment: students were given a case study, published as a project guide in a pdf version, via the learning management system of the university. Students had to work in groups of 4 – 5, they had to model the use case diagram as well as write the use case narrative diagram, for each one of the use cases based on the case study.

The technology characteristics: the textbook's first version was launched, which focused specifically on the components needed to complete the assignment. There was a theory section explaining in detail the theory behind the use case diagrams and narratives, through which students navigated themselves, see Fig. 3.

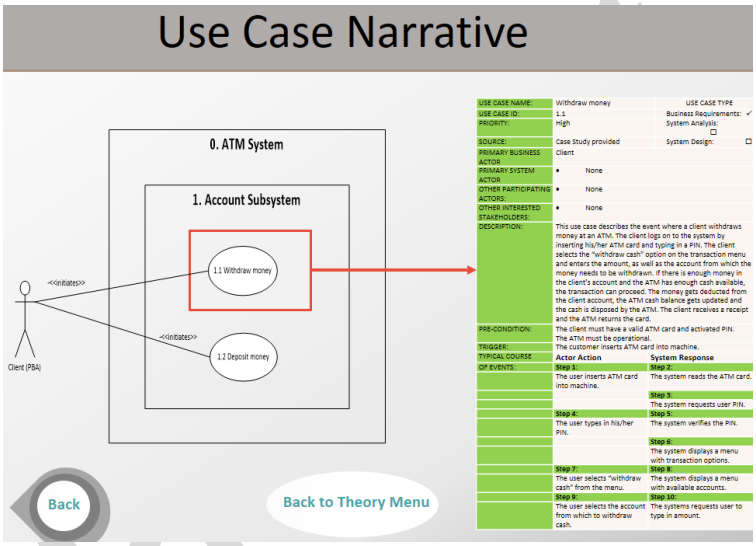

Fig. 3. Textbook – theory section.

In the practical part of the textbook, there are two business cases. Case one shows students how to practically draw a diagram based on a specific case study, connecting to the memorandum on a Google drive, thus connectivity was required to access this part of the textbook. There was also a second case study, created by students and published by Steyn *et al.* [20] showing a video of how one will practically draw a use case diagram, with sound included. See screenshots below:

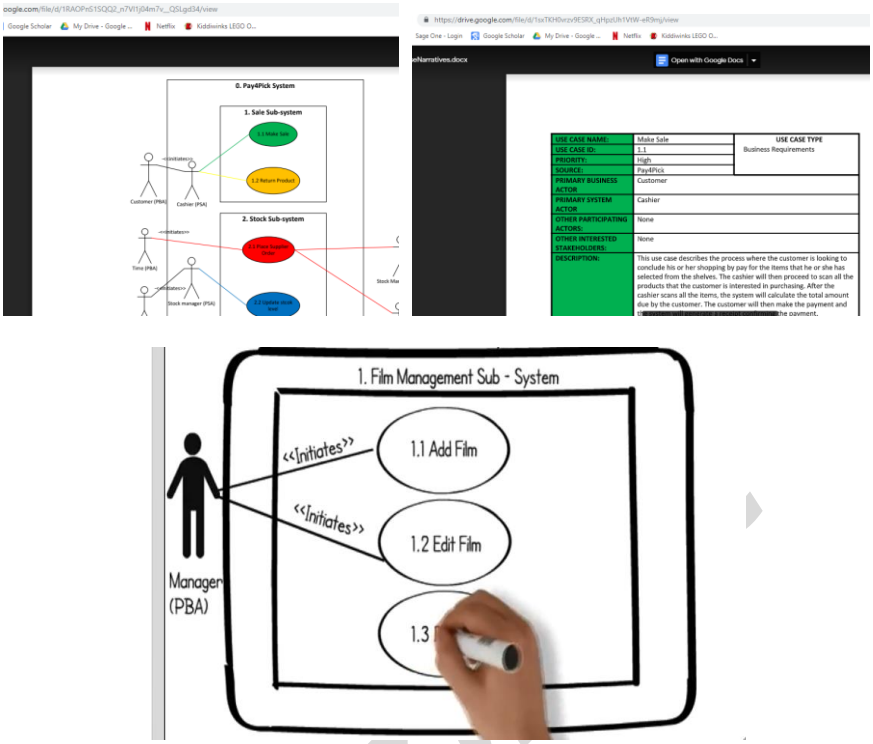

Fig. 4. Textbook – Practical section.

The idea was to see if students felt the textbook assisted them in completing their assignment, and in the end improved their performance.

3 Methodology

Background to the Study

One of the key problems of an undergraduate module at an urban university, is the absence of a proper textbook that focuses on all the aspects of the module. This module is a first-year business analysis and design course with 341 students enrolled in the module.

The students enter the university assuming there is a textbook for each module. The thought of creating our own e-book emerged and the starting point of the textbook was by getting the students to design and contribute [20] to the content. The textbook would be cost-effective to develop and module specific. The first version of the textbook was launched in July 2018.

After the students completed a specific assignment, where they had to utilise the textbook, they were asked to complete an online survey. No marks were allocated for

completion of the survey. The survey data was exported to Microsoft Excel and statistically analysed using IBM statistics SPSS version 25. One of the authors assisted in the statistical analysis.

The methods used during the analysis of the data are Frequency analysis per question; multiple response frequency analysis; Descriptive statistics such as median, and standard deviation; Cross-sectional analysis; Graphical analysis such as pie charts and bar charts.

4 Findings and Discussion

4.1 Background to Participants

The total number of responses received from the survey was 171, of which 170 were completed in full. However, as this paper focus specifically on generation Z, it is important to proof the age of the respondents. As this study took place in 2018, and literature stated that generation Z students were more or less born from 1995, these students should be at most 23 years old. This study did not force students to complete their date of birth. Only 142 participants completed this question and did fall within the generation Z date of birth range. Upon closer investigation, it also emerged that a few students entered 2018 as their date of birth, they were excluded, which means, only 117 usable responses were obtained. Thus the survey had a 34% response rate.

The average age of the students is 20.5 years (mean), with the majority of responses from participants who are 19 years of age (mode). The majority of the students were born in 1998 (35) and 1999 (50) thus correlating with the mean.

Looking at the specific degrees which the students study, the majority (76.8%) of the students study either BIS – Information Science (14,5%); BIT - Information Technology (18,8%) or BCom Informatics Information Systems (43,5%) .With the rest being from BSc Information Technology - Information and knowledge Systems, namely 11,1%. The other students were BCom Financial Science (1,7%). BCom General, BCom Statistics, BEd - FET: General and BSC Computer Science together were 3% of the respondents and BSc - Geoinformatics were from 7% of the respondents.

As the textbook was made available through the learning management system of the university, students could download it to their devices; some of the files however still opened up on a Google Drive (see Fig. 4 above). Thus connectivity had to be determined. Only 8 students indicated that they have no connectivity at all at home. However, all students indicated that they have full Wifi connectivity on campus (wifi is available on campus for all students), thus connectivity does not seem to have been a problem or barrier to using the textbook.

In order to get an idea of their learning styles and preferences, they had to indicate how they prefer to learn and who they will go to first for assistance. To determine their learning style preferences, Fig. 5 clearly indicate that most students will work through case studies, this makes sense as this part of the assignment was practical modelling and by actually drawing it, one does learn better. Attending tutor sessions was also a preferred learning style as well as collaborating with their fellow students.

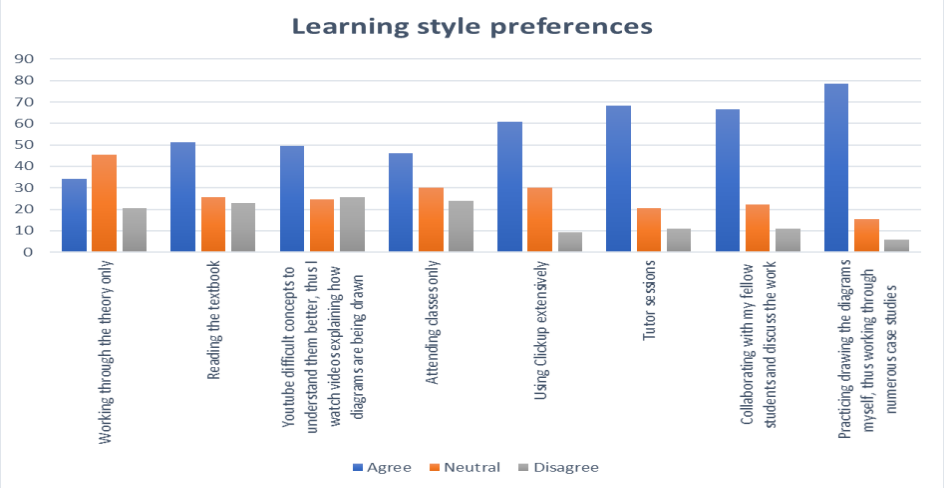

Fig. 5. Learning style preferences.

Linking in with the learning styles, and asking students who they approached first when they struggled with completing the assignment, it was clear that this was a group assignment, as "my group members" ranked first. This correlates with Seemiller and Grace [7] who stated that they are independent workers but they will engage with their "resources", being it fellow students, Youtube or lecturer, on their own terms.

Table 1. Who do you ask first for assistance?

Rank who you go to first for assistance	Ranking
My group members	1
Prescribed textbook	2
YouTube	3
Assistant lecturers	4
Lecturer	5
My Fellow classmates	6
Library	7
Interactive textbook	8

Linking back to the call by literature to make academic tools more visual, it is clear from most of the answers that the students prefer the visual aids and if we don't give them the tools, they will either google or YouTube to find answers. Although the interactive textbook ranked last from Table 1, it was a bit alarming, but also made sense as this was the first time these students were exposed to such a device. Fig. 6 did however show that the students used the interactive textbook on a more regular basis although they previously said they did not go to it as a first point of reference. This does show though that the technology provided indeed seem to the students helpful for completing their assignment.

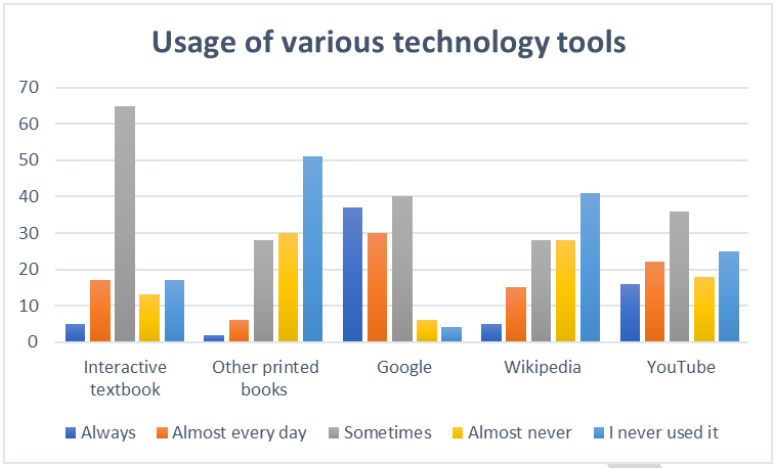

Fig. 6. Usage of various tools for completing assignment.

4.2 Textbook Specific Characteristics and Usefulness

As one of the main features of the interactive textbook is to provide students with more options to gain knowledge, students were asked "If I were given practical examples in an electronic format, I would rather study using". Fig. 7 clearly shows that students still prefer classroom interaction with their lecturer but most of them also prefer electronic examples. Half of the students said they prefer the textbook and most of the rest are neutral with only 10% stating they don't prefer using the textbook.

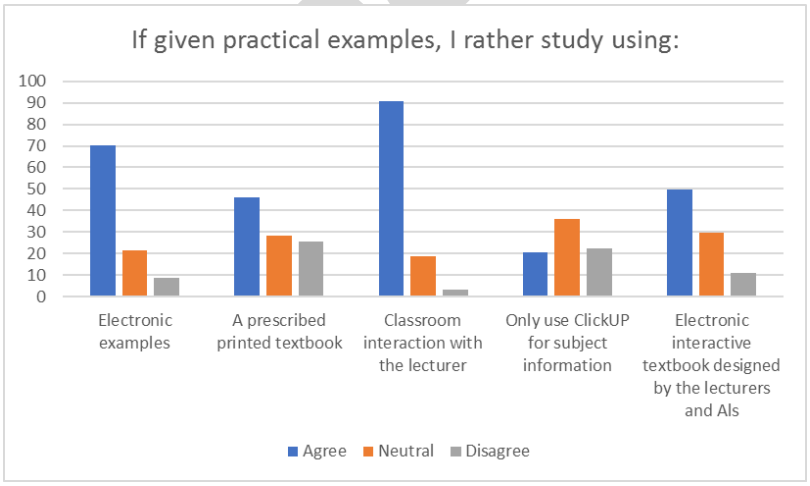

Fig. 7. I would rather study using.

One has to understand their experience of using the textbook for the specific assignment, based on the various diagrams required to complete the assignment. Fig. 8 clearly shows that students felt the textbook was easy to use for both the use case diagrams and

the theory sections. They also felt that the textbook provided a holistic view of systems however most students felt neutral towards this question. Understanding the scope of the system as well as the textbook itself were easy to use. What is clear from the results in Fig. 8 is that very few students (no response more than 10%) did not like the textbook in terms of the use case diagrams, narratives, creating a holistic view of systems, understanding the scope of the system or the textbook itself.

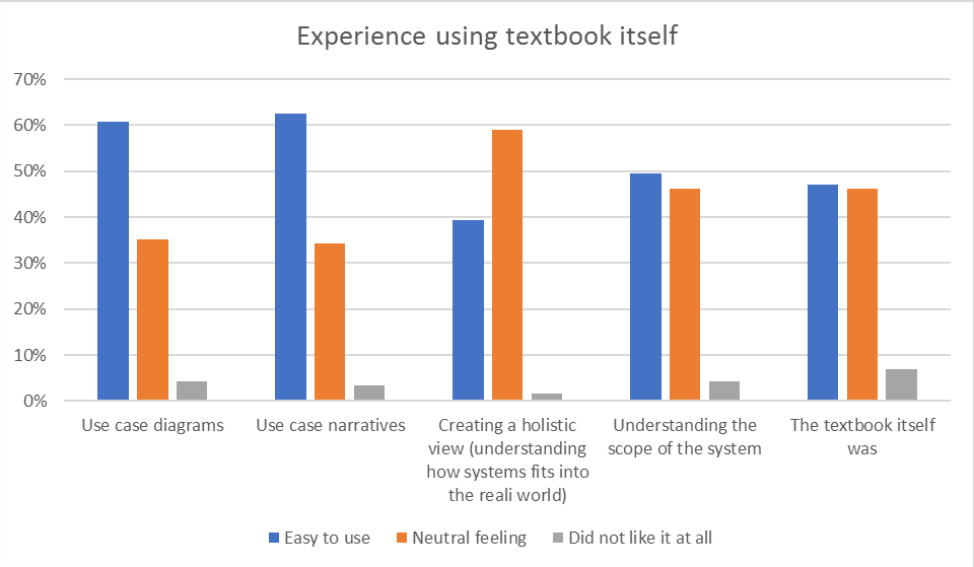

Fig. 8. Experience using textbook.

Continuing on the previous questions, students were asked how they experienced the textbook as a whole. It is clear that they felt the textbook was useful, easy to use and can be used to complete the assignment. They also felt that it could be used to study for tests and exams.

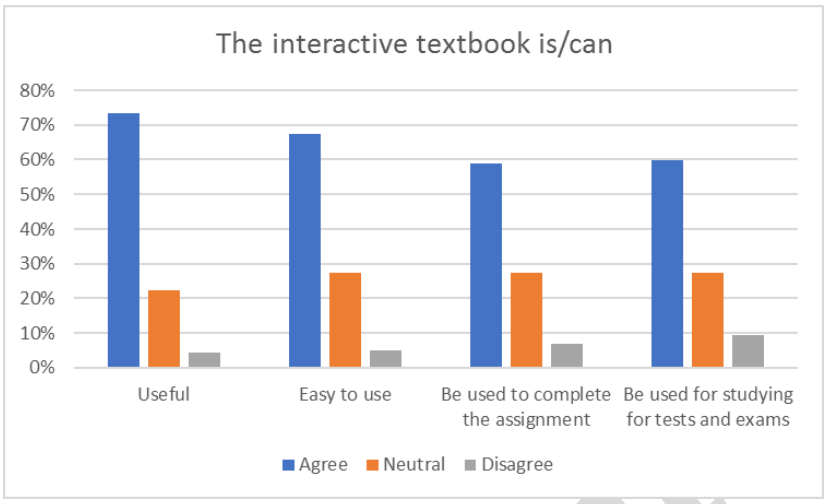

Fig. 9. The interactive textbook is/can.

It is clear from the Fig. 9 that the students had a positive experience towards the textbook and that they felt it is not only useful and easy to use, but can also be used to complete the assignment and even assist them in the future with tests and exams. Few respondents disagree with the usefulness, ease of use and whether they could use it in the future.

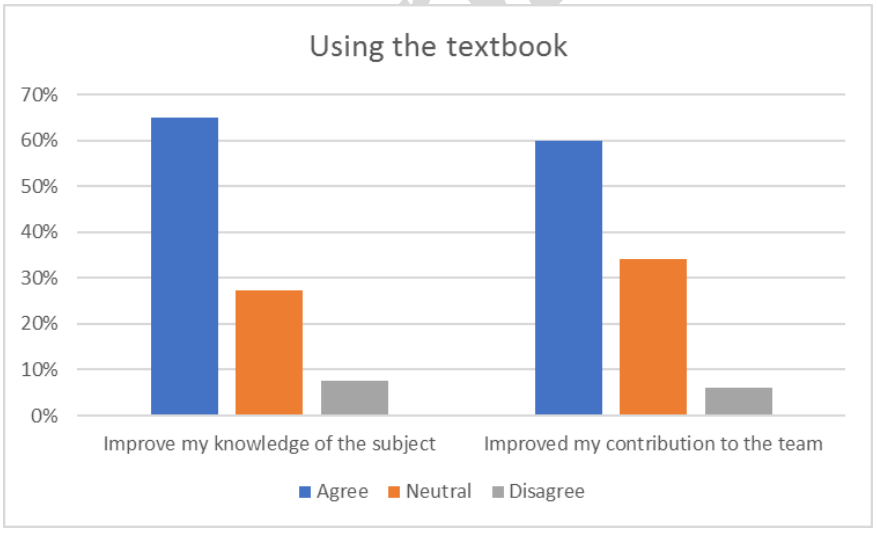

Fig. 10. Experience using the textbook.

The idea behind the task-technology fit theory, is to see if using the technology for a specific task, did indeed increase the student's performance. To determine if the interactive textbook does indeed have a link towards the actual usefulness, and in the end, increase the performance of the student, cross tabulation analysis was performed. The

following tables show and discuss the results. The standardised residual, which says that if it is 2 and higher, or -2 and lower, is an indication of which cell in the table contributes most to the chi square value. The interpretations of these associations can be viewed in Table 2. For all the cross tabulation analysis, there was a significant association between the two statements, see interpretation column for further explanations.

Table 2. Cross tabulation.

Experience with using the interactive textbook to complete your assignment for:	**Cross tabulation statement**	**Fisher Exact**	**Interpretation**
Use case diagrams	Improve my knowledge of the subject	<0.001	There is a significant association between use case diagrams in the interactive textbook and improving the knowledge of the subject. Standardized Residual is 2.6, thus it was expected to find 11.2 but found 20 responses instead for the correlation between neutral feeling towards technology for the use case diagrams and neutral feeling towards knowledge improvement. Hence more than was expected indicated that they have a neutral feeling that technology would improve their knowledge of the subject. Continuing on this statement, the Standardized Residual of 4.2 indicated that it was expected to 0.4 but in the end found three responses in the correlation between "did not like the use case diagrams" and disagreeing that the technology improved their knowledge. Hence more than was expected indicated that they did not like the technology and that it did not improve their knowledge of the subject.
Use case narratives	Improve my knowledge of the subject	<0.001	There is a significant association between use case narratives in the interactive textbook and improving the knowledge of the subject. Standardized Residual is 2.4, thus it was expected to find 10.9 but found 19 responses instead for the correlation between neutral feeling towards technology for the use case narratives and neutral feeling towards knowledge improvement. Hence more than was expected indicated that they have a neutral feeling that technology would improve their knowledge of the subject. However the Standardized Residual is -2.0, thus it was expected to find 26 but only found 16 for the correlation between neutral feeling

			towards technology for the use case narratives and agreeing that their knowledge improved with the technology. Hence less than was expected agreed that technology improved their knowledge of the subject. Continuing on this statement, the Standardized Residual of 3.1 indicated that it was expected to 0.3 but in the end found 2 responses in the correlation between did not like the use case narratives and disagreeing that the technology improved their knowledge. Hence more than was expected indicated that they did not like the technology and that it did not improved their knowledge of the subject.
Creating a holistic view (understanding how systems fits into the real world)	Improve my knowledge of the subject	0.022	There is a significant association between "Creating a holistic view (understanding how systems fits into the real world)" and improving the knowledge of the subject.
Understanding the scope of the system	Improve my knowledge of the subject	0.001	There is a significant association between understanding the scope of the system and improving the knowledge of the subject.
Use case diagrams	Improved my contribution to the team	<0.001	There is a significant association between understanding the use case diagrams and improving the student's contribution towards the team.
Use case narratives	Improved my contribution to the team	0.006	There is a significant association between understanding the use case narratives and improving the student's contribution towards the team.
Understanding the scope of the system	Improved my contribution to the team	0.006	There is a significant association between understanding the scope of the system and improving the student's contribution towards the team.
The textbook itself was	Improved my contribution to the team	0.019	There is a significant association between the textbook itself and improving the student's contribution towards the team.

From the analysis above it is clear that there are a significant association between the characteristics of the tasks, and the technology used to perform the specific task. There is also a significant association between the student's understanding of the work and improving his/her knowledge and also contribution in a team. Thus it seems as if the textbook, did indeed lead to an increased performance by the students.

This study also found a significant association between the characteristics of the tasks, and the technology used to perform the specific task. It was also determined that students felt they understood the work more and thus improving their knowledge as well as the contribution in a team was also determined. It was also determined that generation Z relies heavily on their peers for assistance even though literature says their social skills are underdeveloped. This means that as academics, we need to understand the generation Z and how they prefer to study, and then create content and tools for them so that they can indeed broaden their own knowledge and become life-long learners.

5 Conclusion

Generation Z thrives on technology, they are always connected to the world around them, and yet, as educators we do not realize the potential this connectivity can bring to our modules. And the scary part is that if we don't bring the content to the students, they will go out and Google or Youtube it anyway, so why are we then needed? Well, we are needed to guide them in filtering the correct information but also to guide them in challenging them to use their "connected time" on something that will make them grow and become successful individuals, rather than only purposelessly flipping through various screens and apps. Bikowski and Casal [8] acknowledged that a large amount of research has already gone into textbook design but "little has been done on customised, interactive textbooks designed focusing on specific content", this paper addressed their call. Is this textbook an answer to this call? Not fully but we do believe that it is a first step in the right way to engage with these students.

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