# Connecting Generation Z Information Systems Students to Technology Through the Task-Technology Fit Theory

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**Abstract.** This study investigated how an interactive e-resource could be used to increase students' performance for a specific Information Systems assignment given. As academics we are struggling to find sources that really talk to 'Generation Z' in the way they prefer to learn. We wanted to determine if we can create such a resource to increase students' performance. This study investigates the usefulness of a self-created e-textbook for Systems Analysis and Design through the task-technology fit theory lens. A quantitative data analysis was conducted on a group of undergraduate Information Systems students. 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' understanding of the work and improving their knowledge as well as their contributions to a team was also found. Generation Z relies heavily on peers for assistance even though literature says that their social skills are under-developed. 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 broaden their knowledge and become life-long learners. Higher education institutions should become more student-centered and less lecturer-centered.

**Keywords:** E-textbook, E-resource, Interactive textbook, Generation Z, Millennials, Task-technology fit theory, Information systems education

## 1 Introduction

Throughout the years, many authors have tried to answer the question: how do students learn [12,17,18]? Already in 1987, Chickering and Gamson wrote a paper entitled *Seven principles for good practice in undergraduate education* [6]. They acknowledged that there was a problem in undergraduate teaching and emphasised the importance of having commitment from faculty members

and students. Their 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. Though [6] was already published in 1987, the same question is still asked and the problem is still relevant [20].

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 [19]. They are almost 'born with a phone in the hand' [17]. This is the generation sitting on our campuses today. Gone are the 'millennials'; now we are engaging *Generation Z* [14,15,20]. 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 [14], because these students are changing annually. However not a lot of evidence shows that 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 [3]. New students enter our campuses annually, which makes adaption of our teaching approaches difficult. Technology, too, is changing so rapidly that one can hardly keep up. Even the 'powerful' PowerPoint presentations are already considered outdated [12,15]. We need to find the best-fit technology for the specific task at hand and see how it works and hopefully that it works. Several publications recommend that more visual tools should be explored as they proved to enhance the learning experience and make students more excited about their studies [12,15,17], such as YouTube, infographics, colorful images, and the like. Shatto and Erwin went so far as to say that one should limit reading to only relevant information [15]. How students use the textbook and its features as well as the instructor's usage should be investigated to see if there is a possible link between the two [7].

This paper explores the notion of a *lecturer-designed interactive e-resource*—some call it an 'interactive textbook'—and how students used the textbook to carry out a specific task. Thereby we followed the *task-technology fit theory*. In this paper we will call it an 'interactive textbook'. Our aim is to investigate the usefulness of the resource specifically for our *Systems Analysis and Design* module. Thus this paper suggests that there is a positive association between the interactive textbook and the actual task which the students had to do.

## 2 Background

### 2.1 Millennials Versus Generation Z

Although many authors differ as to when generation Z was born and who should be included, it seems as if they agreed on individuals *born from 1995 onwards* [4,5,8,9,13–15]. Monaco and Martin's study can already be regarded as 'old' as they still talk about the 'millennials' [12], but they make some interesting arguments about how students learn and, more specifically, their characteristics. They list seven general characteristics, most of which correlate with [6].

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, hence not much free thought on daily planning (limitation for educators); (3) they are team-oriented and less comfortable working alone; (4) they are confident and highly optimistic, with instant access to information at any time, and modest commitment to homework; (5) They are or feel pressured, which leads to a longing for 'instant feedback'; (6) They havd a strong desire to 'achieve'; (7) They are 'conventional' again with a new respect for 'culture'.

According to [5], by contrast, generation Z is connected and craving for a digital world, but their social skills are underdeveloped and they do not feel safe, which is strongly different from the millennials. They are more individualistic and have an increased risk of isolation, anxiety and depression. But they also want feedback immediately and conveniently [15]. They are also more accepting of and open-minded about difference [15]. This different picture should be considered by educators, as we cannot assume the same character traits of millennials and think we are still 'engaging' our students. These changes in the students' mindsets are forcing higher education institutions to become more student-centered and less lecturer-centered.

As academics, according to [12], we need to take a step back, out of the so called 'lime-light', understand the students entering our gates, and ask them how they prefer to learn and what they want to see [12], because our education system was never designed with them in mind.

Shatto and Erwin as well as Vikhrova note that as educators, we have to understand 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 [15,20]. Therefore 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, with practical applications [15], in a more 'hands-on' approach [14]. These students also prefer to learn independently on their own [14]. They see peers and educators as valuable 'resources', but they will engage on their own terms. And lastly, Vikhrova stated that they are 'clip-thinkers' [20]—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 noted that there are four things campuses can do to engage with generation Z students [14]: (1) utilize video-based learning; (2) incorporate intrapersonal learning into class and group work, thereby breaking a bigger project into smaller manageable sections; (3) offer community engagement opportunities; (4) connect generation Z students to internship opportunities. Of these four approaches only the first two (1–2) will be considered in this paper.

### 2.2 E-Textbooks

Key aspects of an e-textbooks are its 'mobility' [3] and how it can 'carry' more resources than a traditional book. Due to these features, educators can create


**Fig. 1.** E-textbook design example


**Fig. 2.** Task-technology fit theory according to [10]

more customized interactive textbooks [3]. This allows the creator of such textbooks to focus more on their contexts of delivery. Bikowski and Casal acknowledged that a large amount of research has already gone into textbook design—however: *"little has been done on customised, interactive textbooks designed within a specific content and with specific course outcomes in mind"* [3]. This paper aims to change this. When investigating e-textbook affordability for students, Baek and Monaghan stated that the textbook must be of a high quality and must also be easy to use [2]. Our interactive textbook, which we describe in this paper, was designed using a tablet 'look and feel', such that its usability appeared familiar to our students. We also ensured that the design was 'clean' for the sake of a better quality textbook, (see Fig. 1).

### 2.3 Task-Technology Fit Theory

According to Goodhue and Thompson one of the strongest indicators for individuals to use technology is if there is a 'system/work fit' [10], i.e.: 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 gives us a plausible reason for applying the task-technology fit theory. This theory states that a user should willingly use the technology for a specific task before we can say that it was 'effective' [1,10], (see Fig. 2)

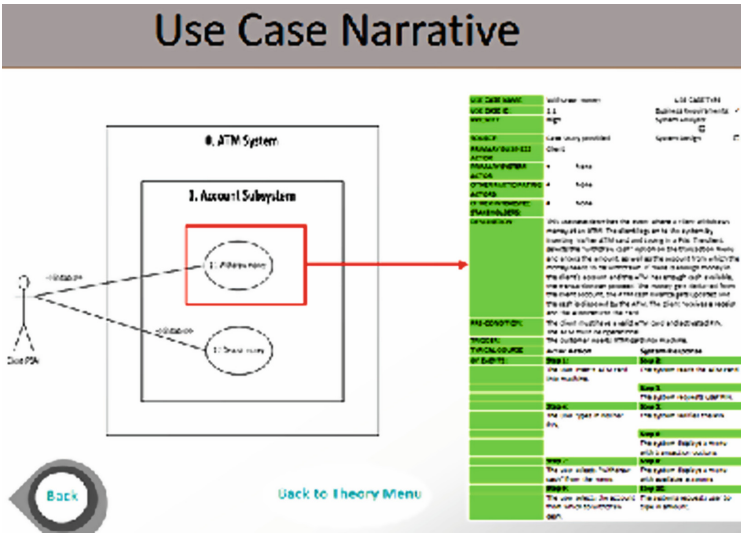


**Fig. 3.** E-textbook's theory section

In our work, this theory was adapted to find out 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, in the end, if they felt it in-creased their performance. The purpose of this study was thus to see if the students found the textbook useful in completing their assignment on use cases according to the task-technology fit theory [11,21].

**Task Characteristics:** students were given a case study, published as a 'project guide' via our online learning management system. Students had to work in groups of 4 or 5; they had to model a use case diagram, as well as write its use case narrative accordingly, for each of the use cases of the study.

**Technology Characteristics:** our e-textbook's first version was launched that focused specifically on the components needed to complete the assignment. It contained a section that explained in detail the 'theory' behind the use case diagrams and narratives, through which students navigated themselves: see Fig. 3.

In the practical part of our e-textbook were two business cases. Case one shows students how to technically draw a diagram based on a specific case study. It connected to a '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 in [16], which showed an audio-video about how one will technically draw a use case diagram (Fig. 4). The idea was to see if students felt that the e-textbook assisted them in completing their assignment and/or improved their performance.

# 3 Method

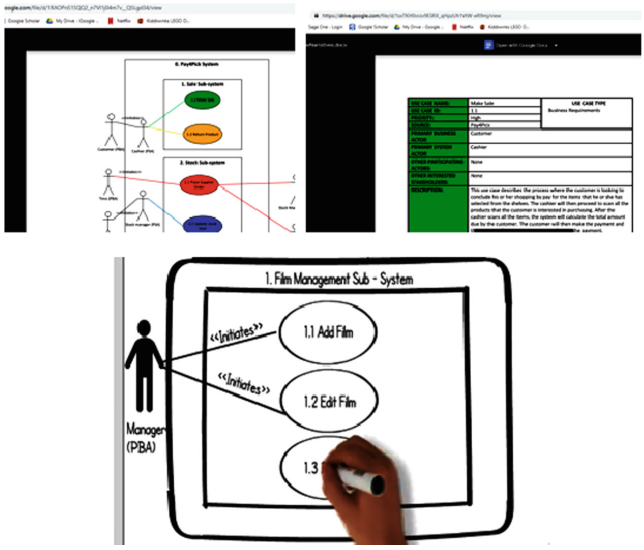


**Fig. 4.** E-textbook's practical section

One of the key problems of an undergraduate module in our context is the absence of a proper textbook that focuses on all the aspects of the module of interest. This module is a first-year systems analysis and design course with 340 participating students. The students enter the university assuming there is a specific 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 contribute to its contents* [16]. 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 our textbook, they were asked to complete an online survey. No marks were allocated for completion of the survey. The survey data were exported to Microsoft Excel and statistically analysed with IBM Statistics SPSS tool (version 25).

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 Participants

The total number of responses received from the survey was 171, of which 170 were completed in full. However, as this paper's focus is specifically on generation

Z, it is important to look at the age of the respondents. As this study took place in 2018, and literature stated that generation Z students were born more or less from 1995 onwards, these students should now be at most 23 years old. However, we did not force our students to disclose their date of birth. Only 142 participants answered this question; they fell indeed into generation Z's birth date range. Upon closer analysis we also found that a few students entered '2018' as their date of birth. These useless answers were discarded, such that only 117 usable responses were obtained. All in all our survey had a 34% response rate.

Accordingly, 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 degrees for which the students study, the majority (76.8%) studies either *BIS Information Science* (14,5%), *BIT Information Technology* (18,8%), or *BCom Informatics Information Systems* (43,5%). Fewer students studied *BSc Information Technology Information & Knowledge Systems* (11,1%) or *BCom Financial Science* (1,7%). *BCom General*, *BCom Statistics*, *BEd FET General*, and *BSc Computer Science* students together were 3% of the respondents, and *BSc Geoinformatics* 7%.

As the e-textbook was made available through our university's online learning management system, students could download it to their devices; some of the files however were located on Google Drive, (Fig. 4). Thus internet connection had to be queried. Only 8 students indicated that they had no internet connection at all at home. However, all students indicated that they have Wifi on campus; thus it seems that there was no internet access barrier to using the e-textbook.

W.r.t. their learning styles and preferences, the students had to indicate how they prefer to learn and who they will go to first for assistance. As shown in Fig. 5, most students prefer case studies; this makes sense as this part of the assignment was practical modelling, and by actually doing it one will learn better. Attending tutor sessions was also a popular learning style, as well as collaboration with fellow students.

In connection with the learning styles, when we asked the students whom they approached first when in need of help, 'group members' was the most frequent answer; (indeed the assignment was a group assignment). This correlates with [14] who stated that students are independent workers but will engage with their 'resources'—fellow students, Youtube or a lecturer—on their own terms.

W.r.t. the 'call' in the literature to make academic tools 'more visual', also in our case most of the answers indicated that the students prefer visual aids. Although our interactive textbook ranked last (Table 1), we hope that this was mainly due to the fact that this was the first time these students were exposed to such a device. As shown in Fig. 6, however, the students used our interactive textbook quite regularly although they previously indicated that they did not used it as *first* point of reference. Hence it seems that our provision was at least somewhat helpful to them.

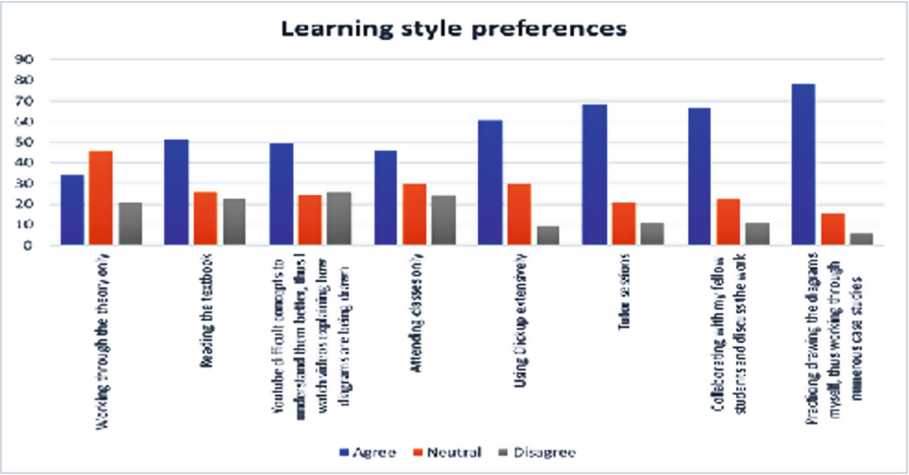


**Fig. 5.** Learning style preferences

**Table 1.** Who do you ask first for assistance?

| Rank | Source |
|---|---|
| 1 | Project group members |
| 2 | Prescribed textbook |
| 3 | YouTube |
| 4 | Assistant lecturers |
| 5 | Main lecturer |
| 6 | Other students |
| 7 | Library |
| 8 | Interactive e-textbook |

### 4.2 E-Textbook-Specific Characteristics and Usefulness

As one of the main purposes of our interactive textbook is to provide students with more options to gain knowledge, students were asked to tell: *If I were given practical examples in an electronic format, I would rather study using...* Figure 7 shows that students still prefer classroom interaction with their lecturer, but most of them also like electronic examples. Half of the students said that they prefer the textbook. The rest were rather neutral with only 10% stating they do not prefer using the tool.

One has to understand the students' experience of using the textbook for the specific assignment, based on the various diagrams required to complete the assignment task. Figure 8 shows that students felt that our e-textbook was easily usable for both the UML use case diagrams and the theory sections. They also felt that the e-textbook provided a holistic view of systems. However, most students felt neutral towards this question. Understanding the scope of the system as well

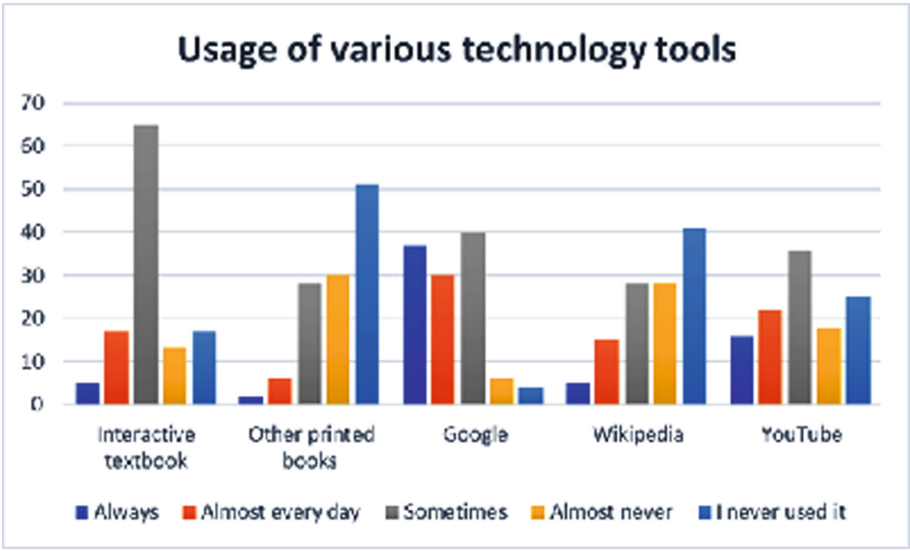


**Fig. 6.** Usage of various tools for completing assignment

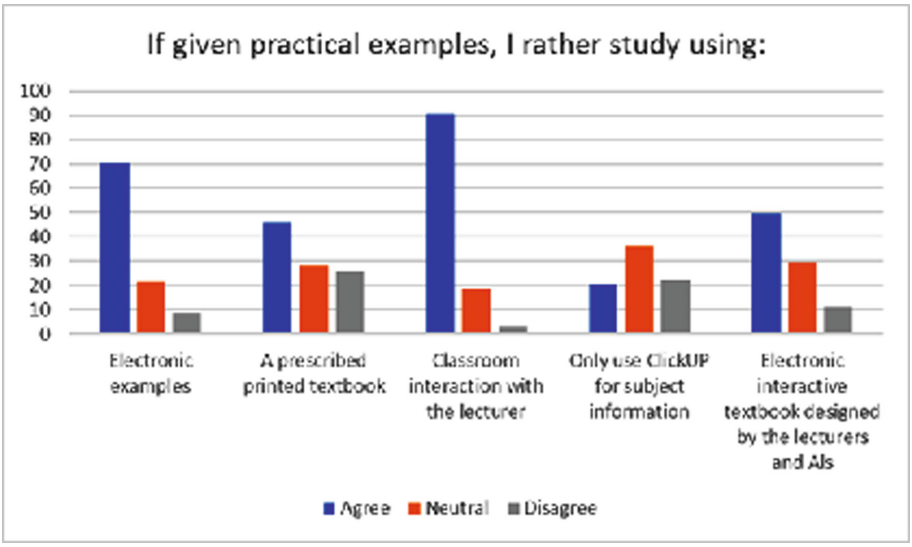


**Fig. 7.** I would rather study using...

as the e-textbook itself were 'easy'. 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.

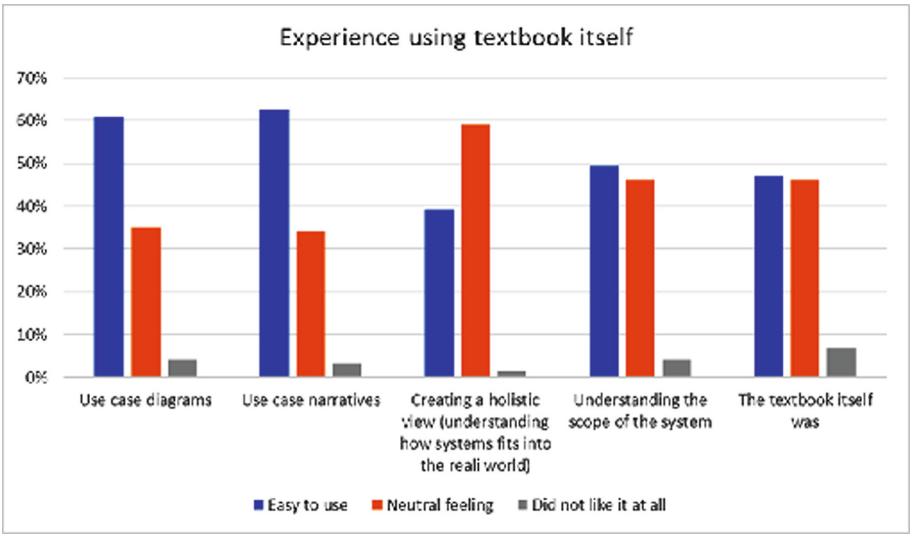


**Fig. 8.** Experience using the e-textbook

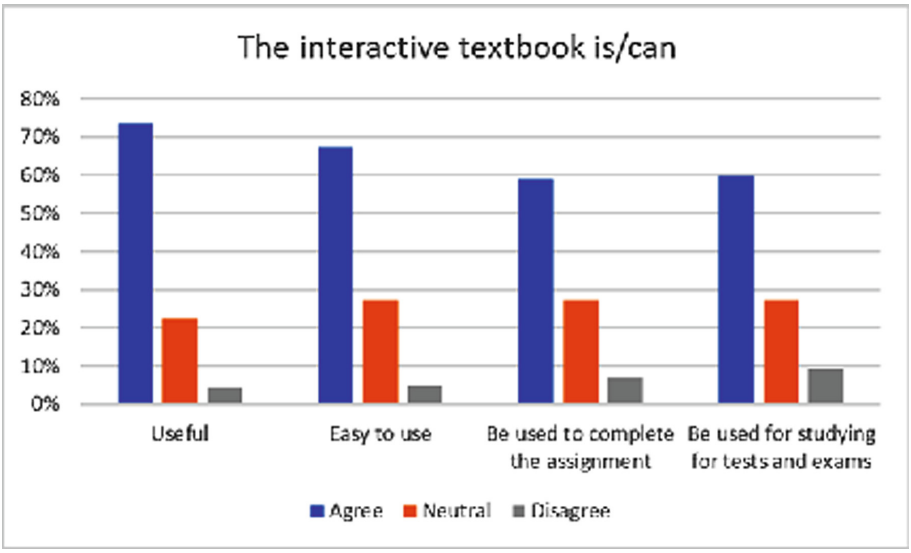


**Fig. 9.** The interactive e-textbook is/can...

Continuing on the previous questions, students were also asked how they experienced the e-textbook as a whole. All in all they felt the e-textbook was useful, easy to use, and also helpful for the completion their assignment task. They also indicated that it could be used in preparations for tests and exams, as shown in Fig. 9. Few respondents disagree with its usefulness, ease of use, or whether they could use it in the future.

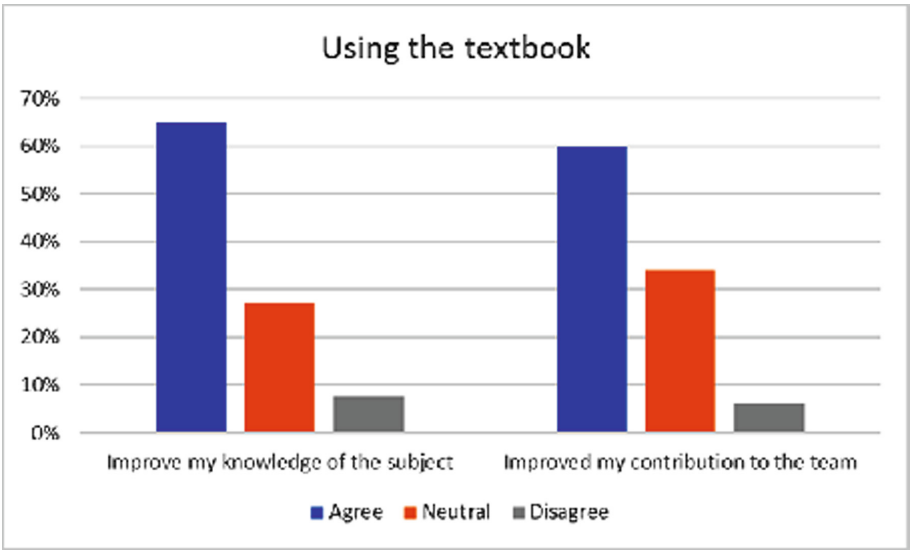


**Fig. 10.** Student's feelings towards using textbook

### 4.3 Task-Technology Fit Theory

As mentioned above, the idea behind the task-technology fit theory is to see if using the technology for a specific task did indeed increase our students' performance: see Fig. 10. To determine if our interactive textbook is really linked with actual usefulness and students' performance, a cross-tabulation analysis was done: see Table 2. The standardised residual—if it is 2 (or higher) or −2 (or lower)—is an indication of which cell in the table contributes most to the corresponding $\chi^2$ value. For all the cross tabulation analysis, there was a significant association between the corresponding statements: see the following *interpretations* (**§1**–**§8**) for further explanations related to Table 2.

**§1** 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 for the correlation between neutral feeling towards technology for the use case diagrams and neutral feeling towards knowledge improvement. Hence more than 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 find 0.4—but found 3—responses in the correlation between 'did not like the use case diagrams' and disagreeing that the technology improved their knowledge. Hence more than expected indicated that they did not like the technology and that it did not improve their knowledge of the subject.

**§2** There is a significant association between use case narratives in the interactive textbook and improving the knowledge of the subject. Standardized

**Table 2.** Cross tabulation w.r.t. the task-technology fit theory

| *Experience with using the e-textbook to complete assignment for:* | *Cross tabulation statement* | *Fisher Exact* | *Interpretation* |
|---|---|---|---|
| Use case diagrams | Improve my knowledge of the subject | <0.001 | See **§1** |
| Use case narratives | Improve my knowledge of the subject | <0.001 | See **§2** |
| Creating a holistic view (understanding how systems fits into the real world) | Improve my knowledge of the subject | 0.022 | See **§3** |
| Understanding the scope of the system | Improve my knowledge of the subject | 0.001 | See **§4** |
| Use case diagrams | Improved my contribution to the team | <0.001 | See **§5** |
| Use case narratives | Improved my contribution to the team | 0.006 | See **§6** |
| Understanding the scope of the system | Improved my contribution to the team | 0.006 | See **§7** |
| The textbook itself | Improved my contribution to the team | 0.019 | See **§8** |

Residual is 2.4; thus it was expected to find 10.9—but found 19—responses for the correlation between neutral feeling towards technology for the use case narratives and neutral feeling towards knowledge improvement. Hence more than 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 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 find 0.3—but 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 expected indicated that they did not like the technology and that it did not improved their knowledge of the subject.

**§3** 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.

**§4** There is a significant association between understanding the scope of the system and improving the knowledge of the subject.
**§5** There is a significant association between understanding the use case diagrams and improving the students' contribution towards the team.
**§6** There is a significant association between understanding the use case narratives and improving the students' contribution towards the team.
**§7** There is a significant association between understanding the scope of the system and improving the students' contribution towards the team.
**§8** There is a significant association between the textbook itself and improving the students' contribution towards the team.

From the analysis of above it appears that there are significant associations between the characteristics of the tasks and the technology used to perform the specific task, as well as between the students' understanding of the work, improving his/her knowledge, and contributing to a team. Thus it seems as if our e-textbook did indeed lead to an increased performance by the students—at least as far as their own opinions are concerned. We also saw that generation Z relies strongly on their peers for assistance even though some literature claims that their social skills would be underdeveloped.

## 5 Conclusion

Generation Z thrives on technology. They are always connected to the world around them, and yet, as educators we often do not realize the potential this connectivity can bring to our courses. If 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 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"* [3]. With this paper we have responded to the call of [3]. Though our prototype e-textbook is not yet fully-fledged and not yet unanimously accepted by our students, we believe that it is a step in the right direction to connect ourselves and our knowledge with the next generation (Z) of students.

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