TITLE:

THE EFFECTIVENESS OF ONLINE ASSESSMENTS IN STUDENTS' SUCCESS DOING ONLINE PROGRAMMING COURSES IN HIGHER EDUCATION

By

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DECLARATION

“I hereby declare that this document: THE EFFECTIVENESS OF ONLINE ASSESSMENTS IN STUDENTS' SUCCESS DOING ONLINE PROGRAMMING COURSES IN HIGHER EDUCATION, submitted for evaluation towards the requirements of the subject: DISSERTATION 481 as part of the Bachelor’s Degree in Computing, at the Belgium Campus, is my own original work and has not previously been submitted to any other institution of higher learning or subject for evaluation. All sources used or quoted in this document are indicated and acknowledged by means of a comprehensive list of references”.

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ABSTRACT

The effectiveness of online assessments in programming courses is a growing concern as more students opt for flexible and affordable learning methods. This study aims to investigate the effectiveness of current online assessment methods in higher education programming courses. The study employs a qualitative research design, involving a survey of 41 students and 4 lecturers to gather data on their experiences and perspectives. Thematic analysis is used to analyze survey data, identifying patterns and themes that contribute to the effectiveness of online programming assessments. The study's findings suggest that online assessments positively impact student motivation, engagement, satisfaction, and academic success. However, there is room for improvement in designing online assessments to better assess students' ability to apply their knowledge. The study's limitations include lecturer availability constraints and the assumption of participants' similar backgrounds and experience levels. Overall, the study provides valuable insights into the effectiveness of online assessments in programming courses and offers recommendations for improving their design and implementation.

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CHAPTER 1: OVERVIEW OF THE STUDY

1.1 Introduction

Assessments are essential for learning, they help students understand their strengths and weaknesses, track their understanding, and receive feedback. The field of computer science and programming are rapidly evolving and there is a growing demand for skilled programmers in various industries, as a result, higher education institutions have seen a significant increase in enrollment of students in online courses. These courses are designed to equip students with the knowledge and practical skills necessary to excel in the dynamic world of software development.

Programming courses typically cover a wide array of topics, ranging from basic programming principles and data structures to advanced algorithms and software design patterns. To ensure that students understand these concepts effectively, assessments are integrated into the curriculum at different stages of the course. Assessments can be done in the form of quizzes, practical coding assignments, exams and group projects.

The effectiveness of assessments is not limited to merely the student's performance, but they promote a deeper understanding of the subject. Frequent assessments allow students to identify their strengths and weaknesses, enabling them to focus on areas that require improvement however, further investigation needs to be done into the most effective assessment strategies specifically tailored to programming courses in higher education. Understanding the relationship between assessment methods, student engagement and achievement is essential for educators and institutions seeking to optimize their teaching practices.

1.2 Background

During online assessments both faculty members and students can experience issues such as the stability of internet access, power failures, and inconsistent quality of visual and audio. There is a lack of student participation and engagement. Lecturers have trouble in conveying messages. Difficulties are experienced when having group

discussions and practical activities (Shyama et, 2021). It was found that the effectiveness of online learning lacked compared to traditional classroom learning because students retained less information. Faculty members and students experienced challenges in adopting online learning. Faculty members had trouble digitizing course material. Students experienced anxiety as a result (Skliarova, 2022). Students experienced a lack of human interaction with classmates, a lack of instant feedback from faculty members and increased interaction with technology and experienced an unwillingness to not listen to lecturers for an extended period (Bornaa, 2023).

There is a lack of methodological knowledge competence of teachers to carry out distance education, psychological problems with the development of motivation and commitment of teachers and establishing new ways of communication. Teachers had to change their teaching practices and strategies such as flexibility with their course material, clarity of communication, and having more than one point of contact with students. Students do not have the private space to attend online classes. First-year students had low satisfaction and wanted more engagement (Skliarova, 2022). Teachers have experienced challenges such as taking time to create presentations in advance and finding new ways of assessing students on virtual platforms (Dhurumraj, 2021).

Online learning is affordable and convenient, students benefit from the flexibility which increased the productivity of their studies. Instead of commuting, they were getting more sleep, studying, working or relaxing. Online learning has improved skills for students such as searching for information on the internet, making presentations and sharing information on online platforms (Shyama et, 2021).

It was found that during the pandemic there was a 200% increase in asking questions on an online website called Chegg which helped students with their problems, exercises, tasks and assessments by receiving solutions. This abnormal increase created a suspicion of cheating and students were not attempting problems they were given. This decreased active learning (Zipperer, 2021).

1.3 Research Gap

There is an increasing popularity of online programming courses in higher education, as more students are looking for flexible and affordable ways to learn programming. There is a limited amount of research on the effectiveness of online assessments in programming courses, this research will help higher education institutions and educators to develop and implement effective assessments. Effective assessment methods are important for ensuring that students are learning their material and mastering the skills needed to be successful in the field of software development.

1.4 Problem statement

The growing trend of students opting for flexible and affordable online learning in programming courses has raised concerns about the effectiveness of current online assessment methods. There is a need for a focused investigation into the specific effectiveness of these assessments in higher education programming courses.

1.5 Research questions and objectives

Main research question:

- What is the effectiveness of current online assessment methods in higher education for programming course?

Sub research questions:

- What is the influence of online assessments on a student's motivation?
- What is the influence of online assessments on a student's engagement?
- What is the influence of online assessments on a student's satisfaction?
- How do online assessments influence the student's academic success?
- How can online assessments be designed to be more effective in assessing students' ability to apply their knowledge?

Main objective: To determine the effectiveness of current online assessment methods in higher education for programming courses.

Sub-objectives:

- To determine the influence of online assessments on a student's motivation.
- To determine the influence of online assessments on a student's engagement.
- To determine the influence of online assessments on a student's satisfaction.
- To determine how do online assessments influence the student's academic success.
- To determine how online assessments can be designed to be more effective in assessing students' ability to apply their knowledge.

1.6 Research design

A qualitative research design was used, which involved collecting and analyzing non-numerical data to gain an understanding of concepts, opinions and experiences (Sharif & Masoumi, 2005). The design aimed to get an understanding of the experiences of participants about online assessments. This allowed for a detailed exploration of factors that contribute to the effectiveness of online programming assessments. A convenience sampling strategy was used which is a non-random sampling whereby anyone could participate if they wanted to (Etikan,2016).

Survey research was conducted whereby participants answered questions, 41 students and 4 lecturers participated in the survey research. The data was analyzed using thematic analysis which is an approach to provide insight into patterns of meanings (Braun & Clarke,2006).

1.7 Delineations and limitations

Delineation: The study only focused on programming. The study only considered factors such as student engagement, learning outcomes and satisfaction levels. The study only focused on tertiary education. Limitations: Lecturer availability to complete surveys made it difficult to gather data because of their busy schedules.

1.8 Assumptions

It was assumed that participants have similar backgrounds, education levels and experience with programming.

1.9 Ethics

Ethical certificate had to be granted to survey student and faculty members at Belgium Campus ITversity. Participants personal information was kept confidential, they had the option to withdraw from the study. They were informed on the research and what their data would be used for. Participants were treated equally regardless of their background.

1.10 Thesis Map

Chapter 1: Overview Of the Study

This chapter highlights the context within which the study was conducted and its background. It includes problem statement, questions and research design of the study.

Chapter 2: Literature Review

This chapter provides a review of the literature that presents the most authoritative study on the research problem.

Chapter 3: Research Design

This chapter outlines how the data was collected and the instrument used and how the data was analysed into meaningful information.

Chapter 4: Research Results and Analysis

This chapter presents a discussion of all the data collected during the research. This involves graphical presentation of the data and qualitative analysis that enable the researcher to arrive at the conclusion of the last chapter.

Chapter 5: Recommendation and Conclusion

This chapter provides the research recommendations and conclusion based on the analsysis and interpretation of data in the preceding chapter.

1.11 Chapter Summary

This chapter introduced the background of the study and reasons to undertake the study. The research questions and objectives, the research design, the ethical considerations, the research gap, assumptions, delimitations, and limitations were outlined. The chapter introduced the qualitative approach, describing the convenience sampling method that was used.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

The literature explores existing literature on the benefits and shortcomings of online learning, the impact on the student's satisfaction and the effectiveness of online assessment methods. It was discovered that online learning is affordable and convenient for students, they do not have to commute to school and the schools do not need to print books because all the course material and content is digital. Students can watch the online classes anytime they can and as many times as they want. Due to the lack of physical interaction, students are not able to fully participate in online classes because they feel isolated from the teacher and other classmates. The lack of participation leads to students not comprehending the work well. It was found that the interaction between students and the teacher and students with the course material had a profound impact on the satisfaction of student who study online courses. It was discovered that online collaborative learning has a big impact on the learning outcome of students, and that formal assessments and teaching methodologies need to be changed to adapt to online platforms.

2.2 Advantages of Online learning

Sadiku, Adebo, and Musa (2018) stated that learning is the transfer of knowledge from one person to another. Online learning is learning using through the World Wide Web. According to Shyama et al (2021), online learning is affordable and convenient for students, this makes them more flexible and more productive in their studies because they do not have to travel to school. Online learning has also improved soft skills of students, students are able look up information on the internet, present and share the information on online platforms.

One advantage found by Al Rawashdeh et al. (2021), is that it makes scientific material interesting for students. This can engage students in the learning process and enhance their motivation. Additionally, online learning provides opportunities for communication and interaction between students and teachers, as reported by 80% of students in the study. This fosters collaboration and creates a community in the virtual learning

environment. Also, online learning allows students to communicate with teachers using electronic mail anytime, offering flexibility and convenience. Another advantage found by Mukhtar et al. (2020) is the flexibility of online learning. Students can access and learn content at their own pace and schedule. Online platforms also provide features for easy administration and monitoring, allowing teachers to manage settings and provide real-time feedback. Moreover, online learning platforms offer accessibility to education, enabling students with confidence or physical barriers to comfortably engage in learning activities through tools like WhatsApp.

Yuhanna et al. (2020) emphasized that online learning provides students the opportunity to engage with diverse content and resources. The internet allows students to access up-to-date information and navigate between documents without leaving their computer. Online communication tools, such as email, enable students to exchange ideas with anyone, regardless of their location. Additionally, the cost of equipment needed for online learning is becoming more affordable.

2.3 Disadvantages of Online Learning

Despite the advantages, there are also disadvantages associated with online learning. Skliarova (2022) conducted a study to find the disadvantages of online learning, the author found that students and faculty members experienced issues such as stability of internet and power failure, which made the online learning experience poor. There was little to no student participation and student engagement, due to teachers having difficulty conveying instructions, which resulted in students retaining less information (Bornaa,2023). Techers experienced trouble digitizing course materials, trouble giving back feedback and low moral to teach. Students experienced anxiety due to a lack of social interaction.

Al Rawashdeh et al. (2021) found that online learning can hinder social interaction and make students feel isolated, as reported by 73% of the students in their study. The lack of physical interaction makes collaborative learning and exchanging ideas between students more difficult. Students may also be prone to distractions, such as surfing the

web or engaging in unrelated activities, which can negatively impact concentration during online learning.

Mukhtar et al. (2020) highlighted the inefficiency of online learning for certain subjects that require hands-on training and practical experience. The absence of physical interaction and manipulation of physical models can limit understanding in these subjects. Online learning also lacks immediate student feedback, making it challenging for teachers to gauge students' understanding and provide real-time guidance. The absence of continuous and immersive learning environments can further affect concentration and attention during online lectures. Additionally, the reliance on digital devices and stable internet connection creates a financial burden for students without access to these resources (Mukhtar et al, 2020).

Another disadvantage, mentioned by Mukhtar et al. (2020), is the issue of maintaining academic integrity. Some students may exhibit disciplinary problems or engage in misconduct during online lectures. Additionally, the easy availability of information on the web increases the risk of plagiarism during assessments, as students can easily copy and paste content from online sources.

Student satisfaction and engagement

Weidlich et al (2018) investigated the concept of transactional distance and its impact on the satisfaction of students studying online. Transactional distance is the perceived communication gap between students, and their classmates and teacher in a distance learning environment.

The authors identified different dimensions of transactional distance, firstly transactional distance between students and learning technology (TSDTECH) focuses on students' perception of the distance or disconnect experienced when using learning technology. TSDTECH emphasises the role of technology in mediating the student's learning experience. Secondly, the transactional distance between a student and the content (TDSC) examines the perception of distance or gap between the student and the learning

material. It considers clarity, relevance and accessibility of the content which can influence the student's engagement and understanding (Weidlich et al,2018).

Thirdly, the transactional distance between the student and the teacher (TDST) explores the perceived distance between the student and the teacher. This considers factors including the presence of the teacher, their responsiveness and availability which can impact the student's sense of feeling connected and supported. Lastly, the transactional distance between students (TDSS) focuses on the perceived distance or isolation experienced among students in an online learning environment. This considers factors such as peer interaction, collaboration, and communication, which can affect the student's sense of community and social presence (Weidlich et al,2018).

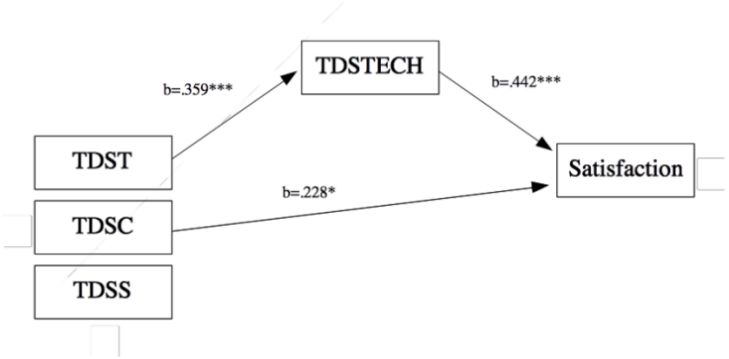

Figure 2.1 | Mediation Model

Source:(Weidlich and Bastiaens,2018, p232)

Weidlich et al (2018) conducted research to examine the relationships between these dimensions of transactional distance and student satisfaction in online distance learning. Figure 2.1 shows that transactional distance, particularly in terms of TDST and TDSC, significantly influenced student satisfaction. TDSS had no effect on student satisfaction. Students who perceived a lower transactional distance with their teachers and content reported higher satisfaction levels. The findings suggest that reducing transactional distance through effective instructional design, supportive teacher-student interactions, and engaging learning materials can enhance student satisfaction in online learning environments. Understanding and addressing various dimensions of transactional

distance, can contribute to the development of more effective and engaging online learning experiences (Weidlich et al,2018).

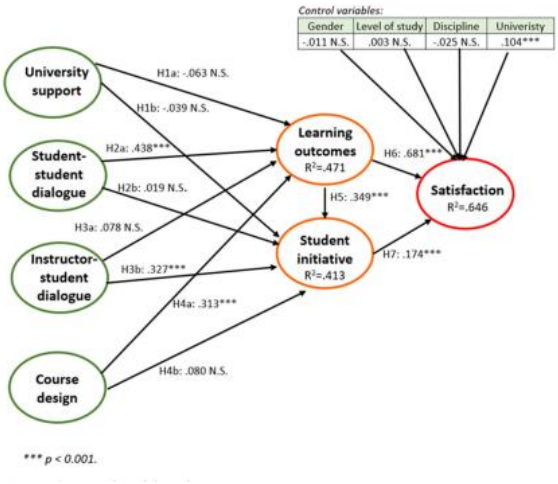

Figure 2.2: Structural model results

Source: (Tsang et al ,2021, p 9)

Tsang et al. (2021) investigated the influences that predict the effectiveness of Covid-19 Online learning (CoOL). The results showed in figure 2.2 that dialogue between students and course design were significant factors of perceived learning, however the dialogue between the instructor and student did not have a big impact on learning outcome which do not align with the findings of Weidlich et al (2018). In online learning, pre-recorded lecturers in preparation of online learning material, this led to reduced dialogue between instructors and students regarding course content and explains why instructor - student dialogue did not affect outcomes in CoOL. Student - student interaction through projects and group discussions played a crucial role in supporting learning outcomes, therefore effective course design that enable students to interact is important for achieving desired outcomes in CoOL (Tsang et al,2021).

Although instructor-student dialogue did not have an enormous impact on perceived learning outcomes, it had a massive impact on student initiative. Interaction with instructors during online classes, and through emails allowed students to seek clarification and engage in critical thinking. This makes instructor-student interaction

essential for CoOl. Learning outcomes have a bigger effect on satisfaction, encouraging student initiative reflects the success of higher education. The academic performance of students influences their preference for learning modes. University support for example academic counselling and administrative assistance may contribute to satisfaction and needs further investigation (Tsang et al, 2021).

Barber (2020) found that both instructor to learner and learner to leaner interaction are important, but electrotonic communication in online classes; lack effectiveness of traditional communication. With lack of peer interaction, student motivation becomes important in online learning and strongly influences learning outcomes and satisfaction. Modifying course structure for online learning indirectly affects student satisfaction and perceived outcome this has similar findings to (Tsang et al, 2021). The role of the instructor as a facilitator and their knowledge significantly impacts the outcomes of learning and the satisfaction in online environment. Positive perceived learning outcomes have a positive effect on student satisfaction, and instructor role contribute to positive learning outcome.

According to Gary et al (2016), there is a significant positive connection between course design and both student satisfaction and perceived learning. Consistency in the course layout template contributes to the importance on course structure for improving learning. Instructor presence has significant impact on both student satisfaction and perceived learning. The more present the instructor is, the more interactive the students become. Learner interaction does not meaningfully affect the satisfaction of students but, there is a positive association between learner interaction and perceived learning. Students believe that interaction with peers is important although it does not affect their satisfaction. Students interact with each other and, their learning is enhanced and contributes to higher perceived learning outcomes.

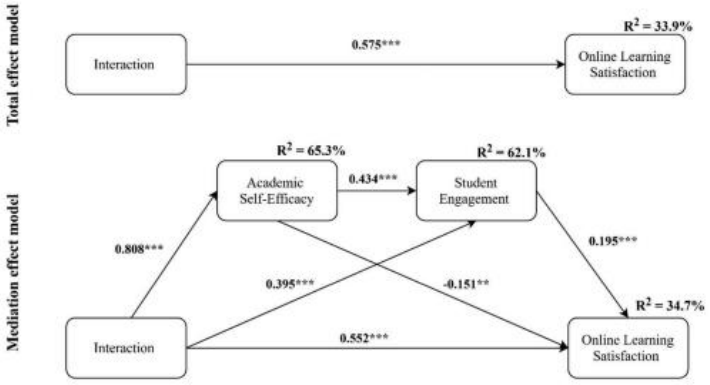

Figure 2.3: Results of structural model

Source: (She at el. p 7)

A study by She et al, (2021) examined the association between the interaction among students and online learning satisfaction among university students in China. The findings showed in figure 2.3 that there is a positive association. Students who interactive during online learning conveyed higher levels of satisfaction. The study also found a positive association between student interaction and academic self- efficacy. The study confirmed a positive association between academic self-efficacy and student engagement. Students with higher academic self-efficacy were likely to engage in learning activities. Students who were more engaged in their studies reported higher satisfaction with online learning. Student engagement was associated with investing more in learning and participating to achieve academic goals (She et al,2021).

Kim et al (2021) found that course design has significant positive impact on the satisfaction of students and their academic achievements in online courses. A well-structured course enhances a students' comprehension of course content and improves the efficiency of learning. Both student-student interaction and instructor presence have a positive influence on student's engagement. Instructors have a key role in understanding students' learning experiences and provide valuable feedback to enhance quality of learning. Student engagement positively affects the satisfaction of the student but may not have a big effect on their academic achievement.

2.4 Online assessments

Mahanan, Talib, and Ibrahim (2021) stated that an assessment is an attempt to track the learning progress of a student to reach a learning goal. Self-assessment is a process whereby students evaluate their own learning. A paper investigated the relationship between students' self-assessment behaviour and their online learning performance. The authors found that students who frequently took online assessments after class tended to achieve higher examination scores than those who did not. However, the learning performance of students who demonstrated non-standard behaviours did not necessarily improve even if they took the assessments. Nonstandard behaviours consist of feedback misuse happens when students rely on feedback from previous attempts while answering the assessment, study material misuse happens when students look for answering in study material when they are doing the assessment, multitasking happens when students engage in other learning activities while they are doing the assessment (Yang et al., 2022).The findings suggest that self-assessments can be an effective tool for improving learning, but student behaviour is a critical factor in determining the effectiveness of self-assessments.

Summative assessments are used to confirm what students can do at the end of instruction, is an examination where students demonstrate memorization without having to have a deep understanding of a subject. Summative assessments cover a wider domain of learning compared to formative assessments. Primarily used for grading, award or promoting students from one stage to another (Mahanan et al., 2021).

Formative assessments are used to find evidence to adjust steps during the teaching and learning process. They are an iterative process of establishing what, how much and how well students are learning concerning the learning goals and expected outcomes to inform tailored formative feedback and support further learning. The teacher must provide feedback to students for reflection on their learning and to make improvements. Formative assessments involve collecting and processing students' academic achievement data to provide timely feedback to improve their learning. Online formative assessments are the application of formative assessment conducted using the web and a computer. (Mahanan et al., 2021). Ustun et al. (2020) discuss online formative assessment, which allows

learners to test their knowledge using online tools and receive feedback about their learning process. The authors provide recommendations for implementing multiple-choice online formative assessments, such as providing feedback for each question, using multimedia to enhance questions, and ensuring compatibility with various devices. They emphasize the benefits of online formative assessments, including flexibility in time and location and the ability to take exams without time restrictions. Mukhtar et al. (2020) offers recommendations for enhancing online assessments, which align with the suggestions provided in the previous literature. These recommendations include focusing on targeted interactions that promote deeper understanding, providing comprehensive training for teachers, encouraging collaboration among students, integrating real-world scenarios into learning materials, and implementing plagiarism software to ensure academic integrity.

Authentic assessments are assessments that are realistic, performance-based, and complex. Students must defend their answers and the assessment must be formative. Students must know what the grading criteria are. The emphasis is on the process as well as the product. They allow instructors to assess higher order thinking, instructors can measure the learning process, learning progress and learning products. Authentic assessment on online platforms can include portfolios, independent projects, presentations and collaborative projects that can be collected on which allow students to show their knowledge by applying it. Authentic assessments emphasize direct examination of student performance, it requires the student to be more active and effective. The authentic assessment will show validity and reliability by emphasizing and standardizing assessment criteria based on tasks (Sutadji et al., 2021).

2.5 Advantages of online assessments

According to students found remote assessments convenient due to the flexibility. Online assessments allow examiners to assess remotely and removed logistical barriers for students who are were not able to participate. Online assessments can be designed to be inclusive to accommodate students with disabilities through adjustments such as modifying time and accessible resources. Due to institutions having to ensure that

students have the necessary resources for online assessments it addresses equity of access issues of students (Thampy et al., 2022).

2.6 Challenges of online assessments

A problem of online learning is online assessments, according to Zipperer (2021), during the pandemic there was a 200% increase in asking questions on Chegg, an online website forum for students, which was used by students to get solutions to assessments. This led to students not attempting exercises they were given and decreased active learning. Another problem identified was the ability of teachers to find new methods of instruction, communication and assessment using online learning platforms. This created challenges such as poor time management for asking students to create presentations in advance and, cheating and plagiarism. According to Skliarova (2022), findings indicated that first year students experienced low satisfaction due to the lack of engagement with the teachers.

Technologies that have been implemented for online assessments, have introduced challenges such as audio and video issues. Online content did not let students practice and learn effectively which negatively affected their assessment results. Assessments have three purposes: to inform lecturers and students of progress and to determine a unique path for their learning; to certify students to provide a standard students must meet; to provide information to serve accountability of universities of and lecturers for their success and failures (Rahman et al., 2022).

Poor internet connection is an issue in remote areas and disrupts students' writing assessments. Online assessments only work with closed questions that have limited answers. Students who lack technical skills struggle with online assessments which can lead to poor level levels of assessment. There is a lack of academic integrity and cheating because a student can be with someone during the assessment and students can search for answers on the web. Many secondary school teachers do not have the technical skills for online assessments. Preparation and evaluation of online assessments require a lot of time and effort (Chinyere, 2021).

The impact of physical distance between lecturer and students: due to the lack of physical interaction, the lecturer struggles to establish meaningful communication and engagement with students. This made it difficult for the lecturer to accurately assess the student's abilities and to identify areas of struggle that need improvement. Adaptations resulting from the use of technology for learning: the lecturer faces difficulty in ensuring consistent and fair assessment methods for online students. The lecturer must adapt their approach due to the need to motivate online students to participate and engage through graded assignments. Workload and time management:

The lecturer encounters challenges in managing the workload and time required to provide effective feedback to online students. Grading video assignments and giving personalized feedback individually is time-consuming and complex, this takes time for lecturers to prepare classes (Rahman et al., 2022). DeCoito et al. (2022) highlighted challenges related to online assessment techniques, such as the lack of creative tools and high-quality resources. Teachers express difficulties stemming from limited training and equity issues, including access to technology, technological skills, and support for all students. Technological Barriers: Lecturers were not familiar with Learning Management System causing initial struggles with online assessments. They also had concerns about the reliability of technology as an assessment tool and its impact on assessment quality (Ghanbari & Nowroozi, 2021). There were technical issues such as file compression and internet connectivity affecting assessments. Lecturers were concerned about the security of online exams and the possibility of plagiarism leading to challenges in test design.

2.7 Chapter Summary

Multiple factors need to be considered for online learning to be successful according to previous literature such as interaction, course design, assessments, technical requirements, student's ability to learn alone, and teacher's ability to teach in an online environment. The effectiveness of online learning is questionable.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

Programming courses use traditional assessment methods which are not effective for assessing the skills that students need to be successful. This study investigated the effectiveness of current online assessment methods in higher education programming courses. The study used a qualitative approach to examine the influence of online assessments on students' motivation, engagement, and satisfaction, to determine how assessments influence the academic success of students, and to find out how online assessments can be designed to be more effective in assessing students' ability to apply their knowledge.

3.2 Research approach

A research approach is a blueprint for research that includes a series of actions to follow for data collection during a study (Grover, 2015). The study used a qualitative approach. Qualitative research is a type of research approach that emphasizes experiences and observations of people in natural situations (Sharif & Masoumi, 2005). Qualitative data was collected from students who have done online programming assessments and lecturers who have administered online programming assessments.

3.3 Sampling strategy

The population is the group whereby the research is applied to (Shukla, 2020). The population of this study were the programming lecturers and students of Belgium Campus ITversity. The sampling method that was used was convince sampling. A form of non-random sampling in which individuals from the target population are selected based on practical criteria such as availability at a specific time and their willingness to participate (Etikan, 2016). The participants in the data collection process were students who were currently enrolled at Belgium Campus ITversity and lecturers who were employed by the university at the time. All the participants were from Belgium Campus ITversity. It was estimated that 200 students and 20 lecturers would be the sample of this research.

3.4 Data collection

Survey research is collection of information from participants through their answers to questions (Ponto, 2015). Primary data was gathered from online surveys that were conducted using Google Forms, participants were sent links which they could fill out anonymously.

3.5 Data analysis

Data analysis refers to the process of transforming collected data into valuable information (Taherdoost, 2020). In the case of survey results were examined using thematic analysis. Thematic analysis is a systematic approach used to identify, organize and offer insight into patterns of meaning. This method enables researchers to comprehend and interpret collective meanings and experiences (Braun & Clarke, 2006). Excel software was used to analyse the data. The themes were based on the research questions and the codes were based on the responses of each number on the Likert scales of each question.

3.6 Ethical considerations

According to Cacciattolo, (2015), a researcher should prioritize the safety and wellbeing of participants and ensure that they are protected from harm and unnecessary stress during the study. Participants could choose to not continue with the surveys at any time. The objectives of the study were clearly communicated to potential participants prior to the decision they make to either consent or decline participation. Personal data was not collected, and personally identifiable data was anonymized so that the data could not be linked to any individual using coding. Coding is a form identifying meaningful segments within data and labelling it in an easy way that can be easily identifiable (Skjott Linneberg & Korsgaard, 2019).

Table 3.1: Research Timeline

Description	Start date	End date
1. Data collection	20th October 2023	17th November 2023
2. Data analysis	17th November 2023	24th November 2023
3. 1st draft of research paper	25th November 2023	1st December 2023
4. 2nd draft of research paper	2nd December 2023	15th December 2023
5. Final research paper	16th December 2023	15th January 2024

Source: Own compilation

3.7 Limitations and delimitations

Limitations are restrictions that are out of a researcher's control and delimitations are limitations which are set by the researcher, these are boundaries set for the research so that the aim of the study is achieved (Theofanidis & Fountouki, 2018).The limitation of the study was based on how many participants choose to be part of the study – only 4 Lecturers and 41 students took part in the survey, and the delimitations are participants only consisted of students who were currently enrolled at Belgium Campus ITversity and lecturers who were currently employed by the university at the time. This means that the results obtained will be influenced by the university's approach to online assessments. This means that the conclusion that will be reached will not be able to be generalized to the population; therefore, further data collection with students and lecturers in other universities will have to be done in the future.

3.8 Validation and reliability

Validity refers to the degree at which collected data accurately represents the scope of the study, while reliability assesses the extent at which measurement of something is dependable and consistent when replicated (Taherdoost, 2016). To make the data valid

a Likert scale was used in the survey questions. A Likert scale is a scale created to measure participants' attitudes in a way that meets scientific standards. Participants are requested to show their degree of agreement with a statement using a standardized metric scale (Joshi et al., 2015). This scale made coding the data of participants accurate.

3.9 Chapter Summary

The intent of the research was to find out the effectiveness of current online assessments in higher education for programming courses. A quantitative approach was used. The data collection was done using surveys. The data analysis was conducted using excel software, the data analysis technique that was used was thematic analysis.

CHAPTER 4: DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

This research was conducted to find out the effectiveness of online assessments in programming courses by answering the research questions. To carry this research out lecturers and student at Belgium Campus ITversity were sent surveys using google forms. Over a period of 3 weeks a total of 41 students and 4 lecturers participated in the data collection process. A thematic analysis was used to gain insight into the data. This is a systematic approach used to identify, organize and offer insight into themes of meaning (Braun & Clarke, 2006). The themes were based on the research questions:

1. How do online programming assessments influence the satisfaction of students?
2. How do online programming assessments influence the engagement of students?
3. How do online programming assessments influence the motivation of students.
4. What challenges are experienced writing online programming assessments?
5. What is the influence of online programming assessments on the academic success of students?
6. What improvements to online programming assessments can be implemented?

4.2 Thematic analysis

4.2.1 Theme 1: The satisfaction of students writing online programming assessments.

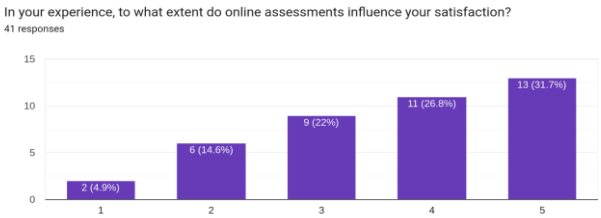

Figure 4.1 Student satisfaction. | Source: Own compilation

Strongly Negative: 4.9% of students

Students reported that online programming assessments often do not satisfy their curiosity or provide them with the real-world challenges that they are seeking and that assessments often feel like arbitrary tasks that are not meaningful or connected to their learning goals.

One student stated that:

> *“They do not satisfy my curiosity, need for real world challenge and often leave me feeling like I am performing arbitrary tasks.”* This can lead to feelings of dissatisfaction.

Some students also expressed the feeling that they are being neglected by their instructors when they are assigned only online programming assessments, for example, one student commented that:

> *" Seems like we are being neglected".*

Negative: 14.6% of students

Students reported that one of the things that negatively affects their satisfaction with online programming assessments is the lack of control they have over their group work assignments. This can be frustrating for students who have had bad experiences with group work in the past. For example, one student commented that:

> *"I just want to be able to pick my group because there are few people I would work with."*

Students also reported that they would appreciate more open-ended questions in online programming courses. This is because open-ended questions allow students to demonstrate their critical thinking and problem-solving skills in a more creative way. For example, one student commented that:

> *"I would appreciate it if more open-ended questions were asked."*

Some students also reported that they feel less motivated to put in effort in online programming assessments. This is because online assessments can sometimes be easier to cheat on than traditional in-person assessments. For example, one student commented that:

> *"There is a slight decrease in satisfaction because I feel like I don't have to put in as much effort in an online test compared to a real test."*

Students also mentioned a few other issues that can negatively affect their satisfaction with online programming courses, such as load shedding and technical problems with the assessment system. These issues can be disruptive and frustrating for students, and they can lead to decreased satisfaction overall.

Neutral: 22% of students

Students who reported that online assessments do not affect their overall satisfaction with their courses provided a variety of reasons for their responses. Some students simply said that they are "unphased" by online assessments. However, the most common among these responses was that students' satisfaction with online assessments is primarily influenced by their marks. Students who report that they are satisfied with their marks are more likely to be satisfied with the assessment itself, even if they did not enjoy taking it. For example, one student commented that:

> *"it influences my satisfaction when my marks are shown at the end and have done well."*

In some cases, students reported that their satisfaction with online assessments was negatively affected by unexpected marks. For example, one student commented that:

> *"Reflex mark was unexpected but it's acceptable."*

This suggests that students appreciate it when they are given clear and accurate feedback on their performance, so that they can understand their strengths and weaknesses.

Postive: 26.8% of students.

Students reported that one of the things they appreciate most about online programming assessments is their convenience. Online assessments can be taken from anywhere, at any time, which can be helpful for students. For example, one student commented that:

> *"Online assessments can be more convenient at times, especially in the case of the video presentation or a class test that was properly checked."*

Students also appreciate the immediate feedback that online programming assessments provide. This feedback can help students to identify their strengths and weaknesses. For example, one student commented *that:*

> *"When I get to see my mark immediately after submitting, I feel free knowing that I either passed or failed."*

Students also acknowledged that online programming assessments have some drawbacks, such as technical issues and the emotional impact of in-person assessments. However, they believe that the positive aspects of online assessments outweigh the negative aspects. For example, one student commented that:

> *"This method offers convenience and immediate feedback, there are drawbacks such as technical issues and the emotional impact of in-person assessment. By balancing positive and negative aspects, online assessments create a diverse experience in terms of satisfaction."*

Strongly Positve: 31.7% of students

Students reported they liked the flexibility and convenience of online assessments. Online assessments can be taken from anywhere. For example, one student commented that:

> *"As someone who lives overseas, having the ability to still study without having to find a Centre to write exams makes it a very pleasant experience"*

4.2.2 Theme 2: The engagement of students writing online programming assessments.

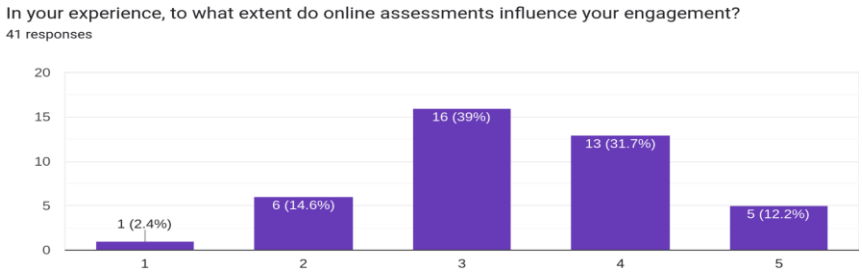

Figure 4.2 Student engagement | Source: Own compilation

Strongly Negative: 2.4% of students

Students found that online programming assessments often led to procrastination. They felt that they had plenty of time to complete the assessments, so they would often wait until the last minute to start working on them. This could lead to rushed work and a decrease in engagement. An example of a student response:

> "I *even do them at the last second."*

Negative: 14.6% of students

Students found that online programming assessments could be isolating and demotivating due to the lack of social engagement. They missed the opportunity to interact with their classmates and instructors, and they found it difficult to stay focused and motivated. Students also found that online programming assessments could be frustrating due to the lack of real-time feedback. They were often unable to get help if they got stuck, and they had to wait until after the assessment to receive feedback on their work.

Students also found that online programming assessments were often too focused on multiple choice and fill-in-the-blank questions, with very few open-ended questions. This made the assessments less engaging and less challenging.

Examples of responses from students:

> *"As a person that thrives of social engagement, online negatively affects my participation as I am unable to focus and get easily distracted or loss motivation."*
>
> *"Face to face environments feel more real and rewarding."*
>
> *"Being online hasn't changed my interactions in class that much. I am a very introverted person and even being online I still feel self-conscious. The fact that responding and asking questions is optional makes me feel neutral about responding in class, I wouldn't want the optional part to change otherwise it would definitely stress me out. I do feel slightly better that no one can see me or hear my voice when I once in a while pop a question or respond to a question. In a sense it did make me feel a little more comfortable with engaging but it's not a big change."*
>
> *"There is no need to engage as there is not always a response from other individual."*
>
> *"It doesn't feel very engaging as there are very few open-ended questions you actually have to think about"*

Neutral: 39% of students

Some students reported that online programming assessments did not affect their engagement at all. They found themselves just as engaged, or disengaged, as they would be in a face-to-face assessment. Other students reported that online programming assessments led to a decrease in engagement due to the lack of interaction with other students and instructors. They found it difficult to stay focused and motivated in an isolated environment.

Still other students reported that online programming assessments led to an increase in temptation and distraction. They found it easier to get distracted by things around them when taking an online assessment than when taking a face-to-face assessment.

Here are some responses from students:

> *"Online assessment has no effect on engagement as I have never had to engage with anyone while doing assessments."*
>
> *"My engagement is more limited due to me either doing the work or making guidelines/notes."*
>
> *"In both environments I tend to avoid engaging unless the topic interests me. That's just who I am."*
>
> *"It is much easier to get distracted when online compared to in class lessons."*

Positive: 31.7% of students

Students found that online programming assessments could help them to better understand the material and to learn from their mistakes. The assessments provided immediate feedback, which helped students to identify their strengths and weaknesses. The assessments also helped students to clarify any concepts that they were struggling with.

Students also appreciated the convenience and flexibility of online programming assessments. They could take the assessments at their own pace and in their own time. This was especially helpful for students who were working or who had other commitments.

Some students also found that online programming assessments could foster collaboration. They could post questions and get help from other students or from the instructor. This could lead to a deeper understanding of the material and to a more engaging learning experience.

Here are some examples of student responses:

> *"Online assessments influence my engagement a little better than physical assessments, because with the latter it becomes very easy to become*

distracted especially when considering the other students, teachers, etc... who may also be around when completing that assessment."

"I feel more motivated to do the work, seeing as I can do it at my earliest convenience rather than being pressured to do it at a certain time and place."

"It forces me to be more focused and engage with the module for me to be able to answer open ended questions."

"It's good to have online assessment in order to accommodate everyone even if you working u don't have time to go to those places but u can do online assessment."

Strongly Positive: 12.2% of students

Students reported that online programming assessments can enhance their engagement by allowing them to interact with the course material at their own pace and in a comfortable environment. This can be particularly beneficial for students who learn best by working independently or who have other commitments that make it difficult to attend traditional in-person assessments. For example, one student commented those online assessments:

" Allow me to take the test at a time that is convenient for me, and I can take breaks as needed. "

Students also reported that online programming assessments can place them in the same environment as online working, which can help them to develop the skills and resilience they need to succeed in the professional world. For example, one student commented that online assessments are:

" Places you in the same environment as online working. Helps you handle stress in a more comfortable environment ".

4.2.3 Theme 3: The motivation of students writing online programming assessments.

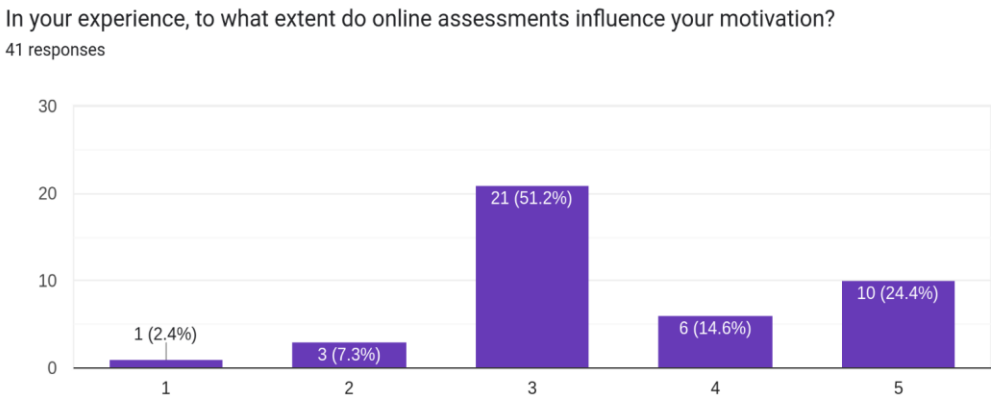

Figure 4.3 Student motivation |Source: Own compilation

Strongly Negative: 2.4% of students

Students said that they are limited to the software and hardware on their own machines compared to using the resources available on campus.

Negative: 7.3% of students

Student responses showed that online programming assessments can be negatively motivating because they often feel like multiple choice quizzes or drag-and-drop exercises, rather than actual assessments. This can lead students to feel like they do not need to study as hard and can make them less likely to give it their all. Some students responded that online programming assessments can be stressful due to the limited time and short answers. This can make it difficult for students to demonstrate their full understanding of the material and can lead them to feel discouraged.

Here are some responses from students:

> *"Online programming assessments don't feel like actual assessments, so they don't inspire me to give it my all."*

"I feel as if I do not study enough because most of the time there is only choose a correct match, drag and drop, multiple choice, true and false, and match the columns."

"The limited time and short answers on online programming assessments make them very stressful."

Neutral: 51.2% of students

The student responses showed that online programming assessments have a neutral effect on student motivation. Some students reported that they were not affected by the mode of assessment, while others reported that they found online assessments to be less motivating or stressful than in-person assessments.

One reason why online programming assessments may have a neutral effect on student motivation is that they can be both convenient and challenging. On the one hand, students can complete online assessments in their own time and in a comfortable environment. This can be convenient and reduce stress levels. On the other hand, online assessments can be challenging, especially if they are well-designed. This challenge can motivate students to learn and improve. Another reason why online programming assessments may have a neutral effect on student motivation is that they can be used to assess a variety of skills and knowledge. For example, online assessments can be used to assess students' understanding of programming concepts, their ability to write code, and their ability to solve problems. This variety can make online assessments more engaging for some students, but it can also make them more daunting for others.

Here are some examples of student responses:

"Online assessments neither increase nor decrease my motivation in an academic context."

"I still treat online assessments like in-person assessments."

"I'm not too affected by it. The amount of effort I put in is determined by the available time and resources."

"Online assessments are generally as fair as sit-in assessments. It's only a question of whether one is prepared or not for the assessment."

"Online assessments have a big effect on how motivated I feel. In subjects that are more about theories, online tests seem like a good fit. But for subjects like Math and Statistics, where it's more about solving problems, using paper for the tests is faster. It helps me to check my answers before submitting them digitally on platforms like Microsoft Teams or Assessmentq tools."

Positive: 14.6% of students

It was found that students found it motivating to be able to take online programming assessments in a comfortable environment, without the pressure of being in a classroom. This allowed them to focus on the assessment and perform better. Students also found it motivating to be able to test their skills on online programming assessments. When they did well on these assessments, it showed them that they were understanding the material and that they were making progress. This motivated them to continue working hard. Some students also found it motivating to be able to talk to someone while taking online programming assessments. This allowed them to get help if they needed it and to avoid having to explain everything halfway through.

Here are some responses from students:

" It makes it more convenient for the student to take the assessment in a comfortable environment away from external pressures. It makes the student more likely to perform well thus motivating them. "

" For convenience purposes, very good, has no disturbance, thus cool as well. "

“It makes it feel quick and easy for access. "

"They allow you to test your abilities. If you understand the work and do well in these tests it motivates you to carry on putting the effort in. "

Strongly Positive: 24.4% of students

Students found it motivating to be able to complete online programming assessments in the comfort of their own homes, using their own equipment, and in a quiet environment. This reduced stress and pressure and allowed them to focus on the assessment. Students also found it motivating to know that online programming assessments are often automatically marked, providing them with immediate feedback on their performance. This allowed them to identify their strengths and weaknesses, and to make improvements in real time.

Students also found it motivating that online programming assessments are often relevant to the computer science course and involve learning new platforms. This made them feel like they were learning valuable skills that would be useful in their future careers. Students also found it motivating to be able to complete online programming assessments at their own pace and in their own time. This gave them more control over the assessment process and allowed them to feel more confident in their abilities.

> *"Completing assessment from the comfort of my own equipment in the quiet of home is the best motivator."*
>
> *"I enjoy online assessments as they are more related to the computer science course, learning new platforms and having the ability to see marks immediately after due to automatic marking improves one's satisfaction."*
>
> *"I feel more relaxed if it's online rather than in-person or face-to-face, as I feel less pressured by the people around me if it's just me in the comfort of my home/own space."*

4.2.4 Theme 4: The influence of online programming assessments on ability to apply knowledge.

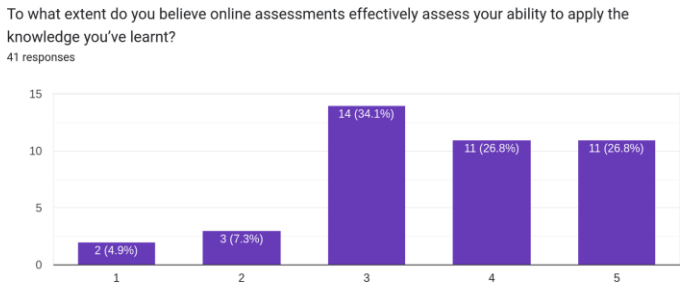

Figure 4.4 Ability to apply knowledge. | Source: Own compilation.

Strongly Negative and Negative: 4.9% of students and 7.3% of students respectfully

The most common response was that the automated marking system used for online programming assessments restricts their ability to apply the concepts they have learned. This is because automated marking systems typically look for specific values or outputs, which can limit students' ability to be creative and to demonstrate their understanding of the concepts in different ways. For example, one student commented that:

> *"Most online assessment facilitates some form of automated marking looking for specific values. This heavily restricts my ability to deploy the concepts I have learnt through the course in favor of providing the special answer the automated marking system favors."* Another student said that *"given that they are auto mark the actual knowledge and application of knowledge is limited at best."* This negatively affects their academic success.

Neutral: 34.1% of students. One of the most common responses was that online programming assessments were like face-to-face assessments in terms of the amount of knowledge required to do well. This suggests that online assessments can be a valid and reliable way to assess student learning. For example, one student commented that:

> *"In face-to-face vs online i applied the same amount of learnt knowledge."*

Other students reported that online programming assessments did a decent job of gauging their ability to apply what they had learned. This suggests that online assessments can be a useful tool for instructors to assess student learning. For example, one student commented that:

> *"In my opinion, online assessments do a decent job of gauging my ability to apply what I've learned."* Another student said that *" With theory-based questions my knowledge can be easily applied, but with programming subjects not that mush since having to switch between screen"*

Positive and Strongly Positive: 26.8% of students each respectfully

One student said:

> *" It is very effective because in the assessment the questions are characterized into lower and higher order questions assess your ability to remember what you have learnt and then to apply what you have learnt in high order question scenarios "* Another student said, *" The idea of an assessment is to test your knowledge not your memory. Trying to remember an answer to a long question is much harder, than just testing your knowledge of a question by giving multiple answers and having to THINK what the correct answer is. "*

These types of responses suggest that online assessments can be designed to be more interactive and engaging, and they can provide students with immediate feedback on their performance. This can help students to identify areas where they need to improve and to make adjustments to their learning strategies. In addition, online assessments can be more convenient for students. Students can take online assessments at their own pace and in their own environment. This can help to reduce stress and anxiety, and it can allow students to focus on their performance which positively affects their academic success.

4.2.5 Theme 5: The challenges of writing online programming assessments.

Challenges experienced by students when they were writing online assessments included; Technical issues: These include slow internet connectivity, platform glitches,

and computer problems. Lack of clarity: Some students reported that the instructions for online assessments were unclear or that the questions themselves were poorly worded. Some students reported that the questions on the assessment were misleading or contained errors. Infrastructure failures: Some students experienced problems signing into the assessment platform or accessing the assessment itself. Some students found the user interface of the assessment platform to be difficult to use or encountered bugs that prevented them from completing the assessment. Boring surface level code scenarios: Some students found the code scenarios presented in the assessment to be boring and unrepresentative of real-world programming tasks. Lack of motivation: Some students found it difficult to stay motivated during online assessments, especially if they were long or complex. Power and internet outages: Some students experienced power and internet outages during online assessments, which prevented them from completing the assessment or disrupted their progress. Difficulty communicating with lecturers: Some students had difficulty communicating with their lecturers during online assessments to resolve technical issues or get clarification on questions.

Challenges experienced by lecturers when administering online assessments included, Cheating: Students may be able to cheat more easily in online assessments than assessments that are written in classes. This can be due to a number of factors, such as the ability to access outside resources during the assessment, the difficulty of invigilating online assessments, and the use of AI tools to generate code. Use of AI tools: Students may use AI tools to generate code for them during online assessments. This can give students an unfair advantage and make it difficult to assess their true knowledge and skills. Students taking a small amount of time writing assessments and still passing: This suggests that the assessments may not be challenging enough or that students are able to find shortcuts to passing. Proper invigilating: It can be difficult to properly invigilate online assessments, especially if there are a large number of students taking the assessment at the same time. This can increase the risk of cheating and make it difficult to ensure that all students are completing the assessment fairly.

4.2.6 Theme 6: The improvements that can be implemented for better online programming assessments.

Responses from students on what could be implemented to improve online programming assessments included: Improve the user-friendliness of assessment interfaces and introduce a reliable auto-save feature. Ensure that every test starts with clear instructions and embed instant tech support for any hiccups. Have someone like a lecturer take the test before students do so they can check for faults and improve testing. Set up feedback mechanisms so students can share their experience right after the test. Provide a mini environment for coding, similar to W3schools, with a place for the code and the right panel for the output of the code. Remove standardized testing and change all online assessments to utilize more hands-on application of knowledge, using things like demo systems and assignments to test the real interaction of knowledge gained.

Increase the complexity of questions and how they are answered. Provide more open-ended questions where students can apply their knowledge and explain their thought process. Allow some open book tests, so that more questions can be asked that test students' understanding of the work and their ability to apply it, rather than just their ability to memorize definitions. Introduce a more interactive format for online assessments, with features such as real-time feedback, interactive simulations, and a variety of question formats. Make it compulsory for students to use software that would lock students' PCs or computers on the browser they are taking the assessment from. Improve the accuracy of automated marking systems. Allow students to begin writing the assessment at a time which they are comfortable with on the day of the exam and make the assessment unavailable at midnight.

Responses from lecturers on what could be implemented to improve online programming assessments included Implement more secure measures to prevent cheating, such as randomized questions, and safe browsers. Offer a variety of assessment types, including multiple choice, open-ended questions, and practical coding assignments. Provide more timely and detailed feedback. Improve the technical reliability of assessment platforms.

4.3 Chapter Summary

From conducting the thematic analysis, the conclusion taken from the analysis showed that the sample is extremely satisfied with online programming assessments. Students feel there is little to no engagement when writing online programming assessments. Students have little to no motivation to write online programming assessments. Students state that the assessments have a positive influence on their academic success in terms of marks and being apply to their knowledge in assessments. Challenges such as technical issues, plagiarism and cheating are confirmed by the research found in the literature review done on online assessments. This study suggests that there is value in understanding the influence of online programming assessments on different aspects of students so that universities that create a blueprint to assessing students doing programming courses so that they can apply what they have learnt and make them industry ready professionals when they are done with their studies.

CHAPTER 5 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This study investigates the impact of online programming assessments, exploring six key research questions related to student satisfaction, engagement, motivation, challenges, academic success, and potential enhancements associated with these evaluative methods. The findings reveal those students generally express positive sentiments toward online programming assessments, citing convenience, flexibility, and prompt feedback as significant contributors to satisfaction. However, a nuanced examination underscores challenges concerning sustained engagement and motivation within the online learning environment. Simultaneously, the study addresses challenges encountered by both students and educators, including technical issues, concerns about academic integrity, and the importance of clear instructions. While identifying a positive correlation between online assessment scores and overall academic success, the investigation raises concerns about the assessments' efficacy in gauging practical application of acquired knowledge. Recommendations derived from the findings suggest enhancements in user-interface design, question diversity, interactivity, anti-cheating measures, timely feedback, and technical reliability. Despite acknowledging positive outcomes, the study emphasizes areas necessitating refinement, serving as a catalyst for ongoing improvements in online programming assessments and urging educators to adapt assessments to align with the evolving demands of digital education and the dynamic requirements of the programming industry.

5.2 Answers to Research Questions

5.2.1 Research Question 1: How do online programming assessments influence the satisfaction of students?

The study's findings suggest that online programming assessments have a generally positive influence on student satisfaction. These findings agree with previous literature by Tsang et al ,(2021) and Weidlich et al (2018). Students appreciate the convenience, flexibility, and immediate feedback that online assessments provide. They also find that online assessments can be helpful for learning and self-assessment. However, some

students reported feeling less engaged and motivated by online assessments, and they expressed concerns about technical issues and cheating.

5.2.2 Research Question 2: How do online programming assessments influence the engagement of students?

The study's findings suggest that online programming assessments can have a mixed effect on student engagement. Some students found that online assessments helped them to focus and stay motivated, while others found them to be isolating and discouraging. These findings agree with previous literature by Skliarova,(2022). Students who found online assessments to be engaging appreciated the convenience, flexibility, and immediate feedback that they provide. They also found that online assessments could be helpful for learning and self-assessment. However, students who found online assessments to be disengaging expressed concerns about the lack of social interaction and the difficulty of staying focused in an online environment.

5.2.3 Research Question 3: How do online programming assessments influence the motivation of students?

The study's findings suggest that online programming assessments can have a mixed effect on student motivation. Some students found that online assessments motivated them to learn and improve, while others found them to be stressful and discouraging. Students who found online assessments to be motivating appreciated the convenience, flexibility, and immediate feedback that they provide. They also found that online assessments could be helpful for learning and self-assessment. However, students who found online assessments to be discouraging expressed concerns about the limited time and short answers, which they felt could make it difficult to demonstrate their full understanding of the material. These findings agree with literature by Al Rawashdeh, (2021).

5.2.3 Research Question 4: What challenges are experienced writing online programming assessments?

The study identified several challenges that students and lecturers experience with online programming assessments that agree with the findings found by DeCoito,(2022). These challenges include technical issues, plagiarism and cheating, lack of clarity in instructions, infrastructure failures, boring surface level code scenarios, lack of motivation, power and internet outages, difficulty communicating with lecturers, and use of AI tools.

5.2.3 Research Question 5: What is the influence of online programming assessments on the academic success of students?

The study's findings suggest that online programming assessments have a positive influence on student academic success. Students with higher online assessment scores generally had better grades and overall academic performance, this is in accordance with findings by Al Rawashdeh, (2021). However, some students expressed concerns that online assessments may not effectively assess their ability to apply their knowledge to real-world programming tasks.

5.2.4 Research Question 6: What improvements to online programming assessments can be implemented?

The study provides a number of recommendations for improving online programming assessments. These recommendations include improving the user-friendliness of assessment interfaces, providing more open-ended questions, introducing a more interactive format for online assessments, implementing more secure measures to prevent cheating, offering a variety of assessment types, providing more timely and detailed feedback, and improving the technical reliability of assessment platforms.

5.3 Challenges and Recommendations

Despite these positive outcomes, the study also identifies areas for improvement in the design of online programming assessments. To effectively assess students' ability to apply their programming knowledge, online assessments should incorporate more practical and hands-on elements. This could involve tasks such as debugging real-world

code, designing, and implementing algorithms, and collaborating on programming projects. By incorporating such practical elements, online assessments can more accurately reflect the skills and competencies required of successful programmers in the industry.

5.4 Conclusion

In conclusion, the study illuminates the dual nature of online programming assessments, recognizing them as effective tools for evaluating student learning while underscoring the imperative for further refinement. The positive influences on satisfaction, engagement, motivation, and academic success are acknowledged, attributed to the convenience and flexibility of online assessments. However, a critical lens reveals challenges such as issues with engagement, technical glitches, and concerns about cheating. To optimize these assessments, educators and curriculum designers must meticulously craft designs that are not only technologically sound but also inherently engaging, motivating, and reflective of real-world programming tasks. The recommendations encompass improvements in user interfaces, inclusion of open-ended questions, interactive formats, secure anti-cheating measures, diversified assessment types, timely feedback, and enhanced technical reliability. This study, thus, serves as a call to action for continuous improvement and innovation in online programming assessments, ensuring their alignment with the evolving needs of digital education and the dynamic demands of the programming industry.

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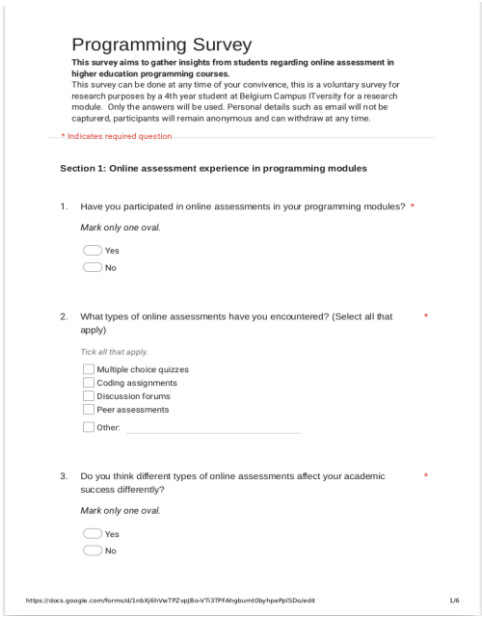
Appendices



Programming Survey

This survey aims to gather insights from students regarding online assessment in higher education programming courses.
This survey can be done at any time of your convivence, this is a voluntary survey for research purposes by a 4th year student at Belgium Campus ITversity for a research module. Only the answers will be used. Personal details such as email will not be captured, participants will remain anonymous and can withdraw at any time.

* Indicates required question

Section 1: Online assessment experience in programming modules

1. Have you participated in online assessments in your programming modules? *

Mark only one oval.

- Yes
- No

2. What types of online assessments have you encountered? (Select all that apply) *

Tick all that apply.

- Multiple choice quizzes
- Coding assignments
- Discussion forums
- Peer assessments
- Other:

3. Do you think different types of online assessments affect your academic success differently? *

Mark only one oval.

- Yes
- No

4. Please descibe the differences you have observed. *

5. In your experience, to what extent do online assessments influence your motivation? *

Mark only one oval.

Strongly Negative
1
2
3
4
5
Strongly Positively

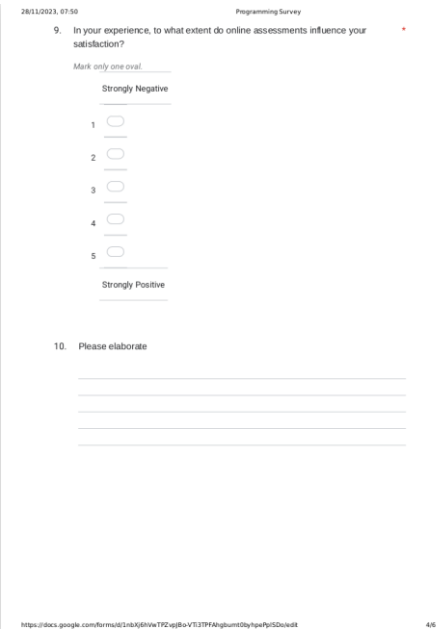
6. Please elaborate *

7. In your experience, to what extent do online assessments influence your engagement? *

Mark only one oval.

Strongly Negative
1
2
3
4
5
Strongly Positive

8. Please elaborate *



9. In your experience, to what extent do online assessments influence your satisfaction? *

Mark only one oval.

Strongly Negative
1
2
3
4
5
Strongly Positive

10. Please elaborate

Programming Lecturer Survey

This survey aims to gather insights from instructors regarding online assessment in higher education programming courses.

This survey can be done at any time of your convivence, this is a voluntary survey for research purposes by a 4th year student at Belgium Campus ITversity for a research module. Only the answers will be used. Personal details such as email will not be capturerd, participants will remain anonymous and can withdraw at any time.

* Indicates required question

Section 1: Online assessment methods

1. Do you use online assessments in your programming modules? *

Mark only one oval.

- Yes
- No

2. What types of online assessments do you use and state why? (Select all that apply) *

Tick all that apply.

- [ ] Multiple choice quizzes
- [ ] Coding assignments
- [ ] Discussion forums
- [ ] Peer assessments
- [ ] Other: _____

3. How often do you administer online assessments? *

Mark only one oval.

- Frequently
- Occasionally
- Rarely

4. In your experience, to what extent do online assessments influence students' motivation? *

Mark only one oval.

Strongly Negative
1
2
3
4
5
Strongly Positively

5. Please elaborate *

_____

6. In your experience, to what extent do online assessments influence students' engagement? *

Mark only one oval.

Strongly Negative
1
2
3
4
5
Strongly Positive

7. Please elaborate *

_____

8. In your experience, to what extent do online assessments influence students' satisfaction? *

Mark only one oval.

Strongly Negative
1
2
3
4
5
Strongly Positive

9. Please elaborate

_____

10. To what extent do you believe online assessments effectively assess students' ability to apply their knowledge? *

Mark only one oval.

Not effectively

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

Very effectively

11. Please elaborate *

12. What challenges have you experienced administering online assessments? Please list and elaborate *

13. What would you change in how you administer online assessments and how would you implement those changes? *

Section 2: Comments and suggestions

14. Please share any additional comments, insights, or suggestions related to online assessments in higher education programming courses *