

Digital assessment, exam preparation & student experiences

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Abstract

INTRODUCTION: The implementation of digital technologies in education and universities has been significantly expanding in recent years. For example, students are increasingly being assessed with the aid of digital technologies. In addition, the COVID-19 lockdowns had universities rapidly switch to an online/hybrid system. This study pursued an exploration into the experiences of students adapting to these challenges and changes. The research question is: How do different digital preparation and examination methods mediate university students' experiences and learning activities?

METHOD: A literature review was conducted. In addition, four students from the University of Groningen were recruited and interviewed. Data collection was done via semi-structured interviews. The approach to inquiry was phenomenological in nature and the method of analysis included a thematic analysis.

RESULTS: Following a thematic analysis, four themes were constructed by the researcher; (1) *Pen & paper preference*, (2) *Navigation and overview differences*, (3) *Digital efficiency*, (4) *Comfortable and disengaged during home-exams*. *Student characteristics* appeared to be major determining factors on how various assessment methods were experienced by students.

IMPLICATIONS AND CONCLUSION: Findings of this study provide insight into students experiencing exam preparation, examination, and assessment, in the context of digital technologies. Considering the rapid digitisation of education, it is important to identify strengths of *traditional methods of assessment*, as well as recognize and realize the potential of *technology-assisted education and assessment*. Student experiences can be of value in pursuit of this.

Keywords: Digital learning, Digital assessment, Exam preparation, COVID-19, Digital education,

Digital technologies, Phenomenological approach, Qualitative, University of Groningen, Students, Online assessment, Essays, Assignments

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The expanded use of digital technologies in education transformed learning in numerous ways. Communication, course information, schedules, syllabi, and so forth are now provided digitally in most Dutch universities, including a multitude of universities across the globe. Furthermore, exams and assessment are increasingly conducted using digital technologies (Jarodzka & Kirschner, 2016; Al-Qdah & Ababneh, 2017; van Baalen et al., 2021). This pervasion of digital technologies in education became even more prevalent during the COVID-19 lockdowns. During this period, universities had to rapidly switch to an *online education* style, and implemented several tools to accomplish a form where students could continue their studies. Furthermore, during the COVID-19 shutdowns at the University of Groningen, where the researcher gained their own insights and experiences on the matter, courses had their way of assessment altered. In its stead came, among other methods, *digital home-exams*, an online examination method which is conducted in the homes of the students. Additionally, other courses implemented mandatory assignments instead of an exam to assess the students.

There is an increasing interest in the improvement of exam scores in the context of digital learning in recent research (Yusefzadeh et al., 2019; Davis et al., 2020). However, regarding students' perspectives and experiences on these (digital) examination methods, little research has been done. Student assessment is deemed critical to test students' education level, knowledge, and competence on a course. Therefore, it should be of relevance for course creators and universities to gain insight into students adapting to and experiencing working with different digital examination methods, including how they prepare for them. For this reason, this paper will focus on the experiences and perspectives of students adapting to digital learning, in the context of different types of assessment and examination methods.

Literature review

A brief literature review revealed that there is little qualitative research on students' experiences regarding different examination and assessment methods - especially in relation to *digital* methods of assessment. In a qualitative study by Yang & Cornelius (2004) on students' perceptions regarding the quality of online education, the researchers investigated positive and negative student experiences regarding online education. According to the authors, the students experienced a *lack of self-regulation* and a *lack of self-motivation*, as well as a sense of *isolation*. However, a positive aspect was that students experienced more *flexibility* participating in online education. The authors also discovered that individual *student characteristics* appeared to significantly influence the way assessment and education methods were experienced by students. Although the research by Yang & Cornelius (2004) was focused on student experiences concerning *online education*, and not specifically on assessment, similar themes could emerge in the current study.

(Digital) assessment and online home-exams

Regarding digital assessment, research using a survey into perceptions on various aspects of digital education from Buzetto-More (2008) revealed that *online home-exams* were seen as convenient by students. However, 45,6% of the students preferred *on-site exams*, with 27,2% exclaiming neutrality. Similarly, Hussain et al. (2020) researched perceptions of students from the *United Arab Emirates* in the context of digital education. They found that students' most cited suggestion was: "Students should be made to take exams on campus, even if course is delivered online" (p. 5). Evidently, home-exams are seen as convenient, yet a large proportion of the students seemed to prefer *on-site exams*. A reason given by students, according to Hussain et al. (2020), was that online exams are unfair, especially for students that normally scored high on exams and showed extensive *exam-preparation*. Online *home-exams* appeared to equalize students' exam results; these authors discovered.

Digital assessment tools are proven to be effective and convenient (Jarodzka & Kirschner, 2016; Henderson et al., 2017). In a literature review by Jarodzka & Kirschner (2016) on *digital exams*, the authors concluded that presenting questions on a computer screen did not affect the tests' reliability. According to these researchers, digital learning and assessment methods can be very effective. For example, digital tests can be organized in such a way that cognitive capacities are not overly taxed, by avoiding unnecessary and distracting information. The research also revealed that students experienced the same level of mental effort on questions presented on paper compared to questions presented on a computer screen. The authors (Jarodzka & Kirschner, 2016) warn that the findings cannot be used blindly to design examination methods; learning does not just involve examination. With respect to this, the author of the current study argues that reliability and effectiveness are not the only factors that should determine the efficacy of an examination method. To enhance the overall learning experiences of students, their perspectives should also be taken into consideration when designing examination methods. The research done by Jarodzka & Kirschner (2016) was quantitative in nature. It would be relevant to explore whether the present study can elaborate on these findings, since qualitative methods are known to be suitable for inquiry into human experiences.

Exam preparation

Regarding exam preparation, some insight may be found in a study by Scouller (1998). In this research, students were surveyed regarding their preparation techniques and perception on two methods of assessment: an *essay assignment* and a *multiple-choice exam*. The results showed more surface learning by the students in the *multiple-choice exam*. On the contrary, students engaged in more deep learning for the essay assignment. These findings did not involve a digital examination method. It would be relevant for the present study to explore

how students experience the extent of surface- or deep-learning, in the context of various *digital assessment methods*.

Furthermore, a recent study into student performances and perceptions on digital exams (Al-Qdah & Ababneh, 2017), led researchers to conclude that the type, an *on-site paper exam* or an *on-site digital exam*, had little influence on student performance. Rather, the extent of *exam preparation* done by students was the major predictor of performance. In this regard, *student characteristics* may play a part in the context of exam preparation as well, in accordance with previous findings (Yang & Cornelius, 2004). Overall, individual characteristics are expected to have a large influence on how students experience the process of exam preparation and, also, how different assessment methods are experienced.

Theoretical framework

In general, the efficacy of digital examination is widely explored in research (Jarodzka & Kirschner, 2016; Davis et al., 2020). Moreover, learning strategies are thoroughly described in studies and literature (Scouller, 1998; Myatsu et al., 2018). However, the research and literature into subjective experiences of students *subjected* and *adapting to* digital examination methods is lacking (Yang & Cornelius, 2004). The existing studies on these aspects are primarily conducted via surveys and other quantitative methods (Buzetto-More, 2008; Qdah & Ababneh, 2017; Hussain et al., 2020). Therefore, this paper will explore the subject with an emphasis on this lacking element and will do so through an empirically-focused framework. An in-depth qualitative exploration will be pursued into the experiences of student learning activities and strategies, including how students perceive and experience different digital examination methods. In particular, the research question that will be explored is the following: How do different digital preparation and examination methods mediate university students' experiences and learning activities?

These subjective experiences will be explored from an *empirical* and *interpretative phenomenological perspective*. Phenomenology, as described by Willig (2013, p. 251), is concerned with the phenomena formed in our consciousness, and influenced by our engagement with the world. An *empirical phenomenological approach* can be used for the exploration of any human experience (Willig, 2013). Considering the phenomenological notion that understanding anything is impossible without any preliminary assumptions, an *interpretative approach of phenomenology* will be embraced in pursuit of exploring the participants' underlying assumptions regarding the phenomena of interest.

Definitions

An explanation of concepts and the methods of assessment that will be discussed throughout this paper is in order at this point. Confusingly, the definitions of *digital learning/education* and *online learning/education* are used interchangeably to describe concepts related to *technology-assisted learning in education* (Luckin et al., 2012; Basak et al., 2018). In the current study, the following definitions will be used: (1) *Digital education* involves all technology-assisted education. This includes (2) *online education*, a form of education which is delivered using the internet (Basak et al., 2018).

Furthermore, *on-site exams* are typical exams conducted in an exam hall together with other students. These can be taken *digitally*, namely on a computer, or on *paper*. Second, *online-home exams*; these were almost exclusively conducted online in the home of the students – primarily in the context of the COVID-19 lockdowns. In the University of Groningen, both *on-site* and *home-exams* generally consist of *essay-questions exams* or *multiple-choice exams*. All the respective types of exams can either be conducted (1) *open book*, or (2) *closed book*. Therefore, these assessment methods will be the focus of the current study. Alternative assessment methods will also be discussed, such as *essay-assignments* and other mandatory forms of assessment.

Method

The method of data collection for this study included semi-structured interviews. The participants were recruited via a convenience sample. The approach to inquiry is done from an *empirical interpretative phenomenological perspective*, as it is described by Willig (2013).

The data-analysis process was done via *Thematic Analysis*, drawing inspiration from Braun & Clarke's (2006) paper, titled: "Using thematic analysis in Psychology".

Data collection

Before we proceed, I will briefly reflect on my own position within this research, because this is necessary for any qualitative research project. First, I am a 26-year-old male Psychology student that grew up in the Netherlands. I have been studying at schools and universities in the Netherlands almost my entire life and I experienced a lot of the digitisation process in education first-hand. This is my first qualitative study and research into this topic. I have not conducted semi-structured interviews in a scientific manner before and I have no experience in coding or Thematic Analysis. Furthermore, being a Psychology student at the University of Groningen, I have experienced *digital exams on-site, paper exams, essays, digital assignments, home-exams*, and many other things that are included in my research design and protocol. This made me better understand the interviewees and aided me in the analysis and interpretation processes. In my opinion, my own experiences enhanced the ability to create an adequate research design and interview protocol, because I know and experienced numerous methods of assessment at the University of Groningen.

For the data-collection process, four participants were recruited and interviewed. Three participants were of Dutch origin, and the last participant was of German origin. Ages ranged from 21 to 26 years old. The genders of the participants consisted of three females and one male. In accordance with the research design, all participants were active students at the University of Groningen during the research process. The study programs the participants

attended are excluded for the sake of anonymity. All the students attended either their third or fourth year of their respective study programs. Two of the four participants were familiar to the researcher prior to participant selection, these were both personal friends. No previous relationship existed between the researcher and the other two participants, and the first interaction was during participant recruitment. Overall, there was little impact on the research process due to the prior relationships. The interviews with the familiar participants were more informal. This led to a natural style of conversation which a positive effect on the richness of the answers. However, the answers of the unfamiliar participants were also rich and elaborate.

The formerly known participants were recruited either in-person or via WhatsApp. No incentive or compensation was given or promised to these participants. The formerly unknown participants were recruited in a WhatsApp study group chat. In this recruitment message the purpose and relevance of the study was stated, as well as a promised compensation that participants would receive in the form of a jar of homemade pesto. Due to the in-depth nature of semi-structured interviews, it is difficult to guarantee total participant anonymity. It should, however, be extremely difficult to identify the participants by anyone other than the author of this paper or the participants in question. Their identities were anonymized in both the transcripts and the excerpts, and pseudonyms are used in the results sections in place of their real names.

All the interviews were taken in Dutch. The interviews were audio recorded and transcribed verbatim into text. Considering the interviews and transcripts were in Dutch, relevant cited excerpts were translated into English by the researcher. The audio recordings were deleted after the research process. All participants were given information about the research design and were asked to give their informed consent via an official form. Both the study information and the informed consent forms were sent to participants via email. The interviewees confirmed their informed consent and provided the filled-in consent forms. The

research proposal was approved by the Ethics Committee of the Faculty of Behavioural and Social Sciences of the University of Groningen.

The semi-structured interviews were held for 45 to 75 minutes, the average length being 55 minutes. An interview protocol was prepared in advance of the interviews with questions relevant for answering the research question, drawing inspiration from both Carspecken's (1995) book, *Critical Ethnography in Educational Research* (pp. 154-164), and a paper on semi-structured interviewing by DeJonckheere & Vaughn (2019). The interview protocol consisted of open lead-off questions, which were mostly descriptive in nature. These are labelled *lead-off questions*, in Appendix A. Each of these questions touched on a topic, namely: (1) *examination on-site*, (2) *exams taken at home*, (3) *exam preparation* and (4) *alternative assessment methods*. The interviews were concluded with two open questions about the general subject. For every topic of interest, several follow-up questions were constructed in relation to the lead-off question. Not all questions were used in each interview, and some follow-up questions that were not included in the protocol arose in a natural response to what the participants were describing. The data-collection protocol was created in agreement with the supervisor of the Bachelor Thesis group. In accordance with this, the co-investigators were instructed to recruit four to six participants currently studying at the University of Groningen, and to conduct the interviews within a few weeks after the creation of the interview protocol. The interviews were held privately with no other people, besides the interviewer and the interviewee, around. The interviews were conducted either in person or in a video call on Google Meet. The interviews took place between November 20th and December 8th, 2022. The transcription process finished two weeks after the last interview. The engagement of both parties, the researcher and participants, during data collection was high, and the data collection process was done in meticulous fashion.

Data analysis

Following the transcription process, the analysis began. The data was first coded using the qualitative analysis program ATLAS.ti. Coding was done in accordance with guidance from the supervisor of the thesis group and by drawing inspiration from Saldaña's (2006) book: *Coding Manual for Qualitative Researchers*. Potential themes that were derived from the data were thoroughly analysed and described. Braun and Clarke (2006) defined themes in the following way: "A theme captures something important about the data in relation to the research question and represents some level of patterned response or meaning within the data set" (p. 82).

The data-analysis included (1) an *inductive* and (2) an *explicit-semantic* approach. The approach to inquiry was (3) *phenomenological* in nature. Lastly, (4) an *overall analysis* was conducted. In summary, this means that themes and codes derived from the data are strongly linked to said data and that the entire data set was analysed. At times, a mixed method, including a *deductive* and *latent-semantic* approach was suitable. The reason for this is that there are some underlying ideas in the data that go beyond the *semantic* content of the data. Moreover, critics state that "All observations are made from a particular perspective, that is, they are standpoint-specific" (Willig, 2013, p. 236). Considering this, the author of the current paper argues that it is practically impossible to analyse anything incorporating solely an inductive and explicit-semantic approach.

The rationale behind this method of analysis is that it is suitable for a Bachelor Thesis project. It is theoretically flexible and does not require a complicated theoretical or epistemological background that is rooted in some of the other forms of analysis, such as Conversation Analysis or Grounded Theory (Braun & Clarke, 2006).

After the initial coding process, the codes were grouped into groups to aid in analysing and navigating the data. Although some of the categories were included in the protocol prior

to data-collection, the code-groups were constructed after the data-collection process and were derived from the data. The entire transcripts as well as the codes and code groups were read and analysed thoroughly. After coding, some themes were constructed by the researcher. Using the coded excerpts and categories, these were consequently worked out in more detail. The analysis was done keeping the theoretical framework and research question in mind. For the full *Thematic Analysis Report*, see: Appendix B.

During the analysis process, the *Thematic Analysis Report* was revised multiple times. Themes irrelevant to the research questions were either removed or refined. Additionally, the data collection and analysis process led to a slightly altered approach in answering the research question. Initially, the research plan included a heavy focus on *alternative examination methods*, such as the tool ‘Slimstampen’. This proved to be beyond the scope of this study. Therefore, the research was narrowed down, resulting in a focus on the elements; *exam preparation, exam taking and assessment* - in the context of digital learning.

Results

The purpose of this study was to explore how students’ experiences are mediated by digital technologies in their learning activities concerning *exam preparation* and *exam assessment*. Four main themes were derived from the data in exploring this question, namely: (1) *Pen & paper preference*, (2) *Digital efficiency*, (3) *Navigation and overview differences* and lastly, (4) *Comfortable and disengaged during home exams*. The constructed themes concern either *exam preparation, assessment, or both*.

Preference for pen & paper

Exam preparation

The first theme is the *preference for pen & paper*. On the topic of *exam preparation*, using pen and paper was often mentioned by the interviewees as the preferred method when taking notes, studying, and even summarizing. Although it was reported to take a lot of time,

writing was experienced positively and described as more engaging and enjoyable. In the following excerpts, both Lisa and Julia explain that writing by hand leads to them remembering material more effectively; Lisa: *“Yes, and when I write by hand, I actually learn the most (best). Then I just remember it well.”* Julia: *“If I write my own notes on paper, I remember it better than if I type it.”* Experiencing longer engagement was mentioned as a contributing factor to the positive experience by Dan: *“Yes, and I like writing notes myself so much. (...) I have to say that it takes more time writing something down so I'm also engaged with it longer.”* Habit may also be a factor for the preference for using pen and paper, as this was implicitly mentioned by Sam: *“No, there are actually many more benefits to working on a computer. But, every time, I just don't do it. Even if I try, I will continue the next lecture... again... writing...”*

Exam taking

Concerning exam taking, the majority of remarks on the differences between digital and paper exams touched on *overview and navigation differences*. The perceptions on these aspects will be introduced in the following theme. However, the preference for pen and paper seemed to apply for exam taking in certain contexts beyond just overview and navigation differences. Dan described tangibility as a reason for their preference: *“I just think it's nicer to work with paper, that's my personal preference. (...) I think the tangible thing about it. That you can kind of move it physically in space.”* Lisa noted the positive experience of having the questions on paper for an *essay-based exam*, whilst being able to type out the answers digitally: *“I was very happy about that, that I had it on paper as well. So, I had both versions, which meant I actually completed the questions digitally (...) That was a really nice combination for me.”* Dan also shared his positive perception on a hybrid examination form: *“I would like to have an impossible situation where I have a paper exam in front of me. Then be able to type the answers, print that out quickly, and then hand it in by hand.”*

Navigation and overview differences

The students reported to experience differences in navigation and overview between paper and digital exams. For clarification, digital exams include both *digital home-exams* and *on-site digital exams*. These types of exams were often identical, the only difference being that home-exams were not taken on-site in an exam hall, but online - in the home of the students.

Ease of navigation and overview in a paper exam

The differences between digital and paper exams had sometimes been given little thought by the participants. Sam, for instance, was unaware of many differences: *“I don't really feel like I see a difference between that. You just can't take notes, I guess...”*. Lisa, however, was outspoken and positive about the ability to keep a good overview on paper exams: *“Because it makes it easier to go back to a question and keep an overview if you are unsure. Yes, I think so. It feels more structured to be able to complete it that way.”* Dan also seemed to enjoy handling paper exams, quoting the ease of navigation as a reason for this: *“Because I just really like having paper in my hands. And you think ‘okay I want to go to page 3 now! **Flump!**’ You're on page 3.”*

Digital exams

Conversely, Julia explained how a well-designed digital exam could lead to a *better* overview experience for them: *“Digitally, you can change it as many times as you want and then you also don't see the previous answer you gave. And then it looks more clear/organized.”* The majority of the participants shared negative experiences with digital multiple-choice exams where backtracking to a previous question was impossible. Lisa: *“Yes, if you can track/scroll back (to previous questions), digital is no problem, but if you can't go back then I clearly prefer printed versions.”* Julia: *“If I don't know a question, I skip it. And if*

you're digitally taking a multiple-choice test and you can't go back to a question you just have to guess (...) And that does stress me out."

According to the students, essay-based exams were not conducted with *pen-and-paper*. For this reason, the students did not refer to *overview and navigation differences* regarding essay-based exams - besides mentioning increased *neatness* for digital essay-based exams. This will be touched on in the following theme.

Digital efficiency

Although all participants claimed to prefer the experience of handwriting over typing if they had the time and choice, they all experienced working with digital technologies as efficient and fast. Additionally, digital technologies reportedly facilitate many methods of assessment that are useful for learning. The ability to do essays, assignments and essay-based exams digitally was experienced positively due to the efficiency, neatness, and speed of typing. For example, Julia mentioned that the ability to type out answers leads to reduced stress: *"Um, well digitally I write faster, because I am typing. I then have less stress in advance, like, okay, I really need to know (the material) so I can give a short answer. Because yeah, with pen and paper, um, it takes me a really a long time writing something out."*

Regarding digital essay-exams, increased *neatness* was another often-mentioned topic. As Dan put it: *"Yes, I like typing. With the essay questions on paper, handwritten essay questions, it can really become a mess. I am therefore simply not satisfied with an answer purely because it could be that the teacher cannot figure it out."*

The efficiency of digital essays and assignments

As described in the main theme, textual assignments and essays are often conducted digitally, and are preferred this way by the students. Although most assignments mentioned were mandatory, they had a positive influence on the learning and exam preparation experiences of the interviewees. These experiences appear to be *mediated* by digital

technologies, because essays and assignments are often *facilitated* by the *efficiency* of digital technologies. Dan recognized this facilitation by digital technologies, stating the following:

“Look there is a deadline, but there is about a week to meet that deadline. But you also have a whole week to engage with the material for a few more hours. And I think the digital aspect facilitates that.” Dan later explained that analogue assignments can be less efficient than those provided by digital technologies: *“...you don't have to use a space to house students on a weekly basis just to make two assignment questions. That, of course, is inefficient.”*

Assignments and *essays* are experienced positively for multiple reasons according to the students. (1) The mandatory nature of assignments incentivized the students to start working with the course material, starting the exam preparation process ahead of time compared to when the student would normally actively start studying for an exam. Regarding this, Dan stated the following: *“Say, I'm a person who reads during the block but who doesn't necessarily study during the block. (...) and so, every week you were going to read up on the material. And every week you had to come up with a new answer to a question you had never heard.”* In the example given by Dan, digital technologies efficiently assisted in providing the weekly assignments to the students. The assignments could technically be provided in an analogue fashion. However, this would reduce the efficiency and possibilities that digital assignments provide.

(2) Furthermore, essays incentivized and require a more engaged, time-intensive, and active working strategy. Consequently, essays and assignments were mentioned to attribute to a positive learning experience because of longer information-retention. Julia mentioned they still remembered the content of an assignment from two years prior to the interview: *“I remember more from the material of essays than from the exams I did. I remember, I made a digital poster about addiction 2 years ago, I basically still remember everything about that.”* The ability to frequently engage with the material and the efficient way assignments and

essays can be conducted is facilitated by digital technologies, resulting in a positive learning experience for the students.

Comfortable and disengaged during home-exams

Home-exams drastically changed the way of dealing with exams and preparing for exams for some interviewees. One of the students, Lisa, had a special arrangement with the university due to them being prone to severe stress and blackouts caused by distractions. Lisa's story was a prime example of how the presence of others can lead to stress, and thereby impede performance on exams. Evidently, home-exams had a positive effect on their learning experiences. Regarding this, Lisa explained: *"I have a separate arrangement that I can't be in a room with 500 students due to distractions (...) I was there but I just couldn't think straight anymore. I couldn't think of anything anymore and execute the right steps... (...) look this doesn't happen, for example, in an online exam at home."* Being highly susceptible to stress and distractions, *online home-exams* were a way for Lisa to take exams with reduced stress – which was of paramount importance for their ability to perform on exams.

In contrast, the experiences of the rest of the interviewees are different. In summary, they; (1) cheated, (2) learned less during the period, (3) experienced social isolation or (4) experienced less focus or motivation. All four students did, however, experience the home-exams as (5) comfortable and convenient. Concludingly, home-exams were not always positive for their learning experiences.

Being in their own environment was one of the reasons given for the disengagement and distractions. As Julia explained it: *"Well, um, I was just sitting in my own room at my desk. And it was kind of full of all sorts of things. So, basically, yes, again it depended on whether I knew the material well or not. If I didn't know the material well, I would go and look around and think, hey, nice *thing*, I need to finish doing that thing!"* Being around familiar objects and in a home-environment caused Julia and Dan to sometimes behave

differently and be distracted by the setting. As Dan stated: *“I have even gotten up during an exam to make a cup of coffee or smoke a fag. I have sometimes smoked a fag in my room during an exam, for example. Those are also distractions you know....”*

According to the students, being socially isolated from studying was one of the prime reasons for the decreased motivation and less engagement with studying. Both Dan and Sam explicitly mentioned that they negatively experienced the lack of social interactions during the *home-exam* period. Dan mentioned to feel disengaged from their studies because of this: *“I could just really appreciate the social aspect of studying. And that just completely went away during lockdown, so I just didn't feel like it anymore. And so, I just learned less during the lockdown than before...”* Sam enjoyed the convenience of *home-exams*, but also noted the lack of social contact: *“I did have a little bit of mixed feelings, because with everything around it, even with exams, I do miss social contact a little bit. But it was nice and easy.”*

The ability to cheat made the period of *home-exams* less stressful for some students. Sam explained their exam-taking strategy as follows: *“I treated them all as if they were open book exams.”* To clarify, consulting study material during *home-exams* was considered fraud, unless specifically stated that it was an *open- book exam*. However, the lack of surveillance during home exams caused the students to be indifferent to this. In addition to this, the students felt comfortable during *home-exams*. Lisa enjoyed utilizing the facilities their home provided, for example: *“I also sometimes went to the toilet. That was really luxurious.”*

In the end, three out of four students claimed they learned and remember less from the period of *home-exams*. Similar to Dan mentioning that they studied and learned less during the lockdown, Julia explained to study less because they could cheat: *“Very little. (...) Because I could cheat at home for most exams, I already had the attitude to just do minimal studying.”* Sam, too, claimed they ultimately learned less during the period: *“I think I did learn a bit less, or remembered less in the end, than I might have done normally.”*

Discussion

Findings

The findings of the present study provide some insight into student experiences regarding exam preparation, examination, and assessment, and the manner in which these experiences are mediated by digital technologies. The interviewed students identified the positive and engaging experience of writing by hand when preparing for an exam. Although typing is more efficient, note-taking and other learning strategies were done preferentially with pen and paper. Explanations given were that it led to better learning, perhaps through longer engagement with the material. Research done by Smoker et al., (2009) and Aragón-Mendizábal et al., (2016) revealed that writing by hand indeed leads to significantly better *memory retention* and *recall*, when compared to typing. Whether this is the sole reason for the subjective preference of the participants in this particular study is uncertain. In the context of *exam preparation*, not all students were cognizant of an explanation for the preference for writing by hand. Another explanation for the preference might be the age-group of the students and the context of their former education. For example, in Dutch elementary schools, students have traditionally been urged to write by hand (“Focus op handschriftonderwijs”, 2013). The preference for pen and paper may therefore also be due to habit. Overall, whether an on-site exam was digital or not, had little influence on students’ *preparation* strategies. Furthermore, it may be argued that the extent of *exam preparation* and *student characteristics* were the salient factors for performance on an *exam*, not the method of assessment, according to the students in the present study. This is in line with previous research (Al-Qdah & Ababneh, 2017; see also Yang & Cornelius, 2004).

Regarding *on-site examination*, the preference for pen and paper somewhat persisted. If time and the examination method allowed it, paper exams were the preferred form for students. This was the case for *multiple-choice exams*, in particular. This may possibly be

attributed again to habit or familiarity. Considering that *examination* is not the same as *exam preparation*, the previously mentioned benefits concerning writing by hand may not be relevant for students taking an exam. *Essay-exam* questions take considerably longer to answer, especially if the answers are required to be written out by hand. Therefore, in the case of essay exams, digital exams were the preferred method by the students.

The students also gave valuable insight on the importance of the ability to keep a good *overview* and the ability to *navigate* an exam. The differences in preference and experiences were smaller when digital exams are designed well. To illustrate, a digital multiple-choice exam with backtracking to previous questions was considered perfectly adequate, while an exam without backtracking was experienced negatively. Evidently, the design and lay-out is of importance for the experience of the students. Jarodzka & Kirschner (2016) reported that tests can be organized in promising ways to increase their effectiveness. Similarly, this holds true for the ability to keep an *overview* and *navigate* an exam, according to the students. A well-designed digital exam can provide benefits with regards to the ability to keep an *overview* on an exam, as well as *navigating* it. Digital technologies hold great potential in supporting assessment, according to the relevant literature. There is, however, little innovation in technology-supported assessment (Luckin et al., 2012). There is a significant disparity between the *potential* and the *reality* of digital technologies implemented in education (Luckin et al., 2012; Timmis et al., 2016).

Students were positive about a hybrid examination method, combining both the *efficiency* of digital exams, and the positive experiences that *pen-and-paper exams* provide. While this may not always be feasible or efficient for course coordinators or proctors, it is important to recognize the strength and limitations of both *analogue* and *digital* methods of assessment.

The *efficiency* of working with digital technologies was repeatedly identified by the students. For this reason, students were content that *essay-exams*, *assignments*, and *essays* are conducted digitally. *Essays* and *assignments* were experienced positively in the context of exam preparation and learning - and as a form of assessment. These forms of *assessment* led students to engage more in *deep learning* in previous research (Scouller, 1998). Similarly, the nature of essays and assignments caused the students in the current study to engage in deep and active learning and retain the information longer. They reported this to be valuable and effective for their learning experiences. It is well established in literature and research that repeated exposure to information over prolonged time periods leads to better long-term memory retention and recall (Hendriksen, 1975). Concludingly, essays and assignments may incentivize (1) more frequent engagement with the material and (2) generally involve more *deep learning*. The latter learning style has also been connected to better learning and info retention in research (Scouller, 1998).

Potentially, many forms of assignments and essays could be conducted without digital technologies. This is, however, intensive, impractical, and limits their potential. The students regarded it as obvious that essays and assignments are conducted digitally. Digital technologies *facilitate* many forms of essays and assignments, due to the efficiency, neatness, and flexibility they provide. Three out of four students were vocal about the way assignments and essays had a positive influence on their learning experiences. These were also the students that reported to study one week, or less, for a regular exam. As expected, *student characteristics* seemed to have influenced how (digital) learning and assessment methods are experienced (Yang & Cornelius, 2004). In the current study, the nature of mandatory assignments and essays had a particular positive effect on the learning experiences of students that reported motivation problems. Certain methods work better for some students, compared to other methods.

Home-exams mediated student experiences concerning both *exam preparation* and *assessment* considerably. Again, student characteristics greatly influenced how *home-exams* were experienced. For the student that was susceptible to stress, blackouts and distractions, home-exams were a way to perform on exams with reduced stress. The remaining students reported a lack of *motivation* and were less *engaged* with their studies. The students' lack of motivation and the ability to cheat appeared to be the primary reason of the negative learning experience concerning home-exams. It led to a disengagement from their learning activities. This was exacerbated by the fact that the period of *home-exams* entailed social isolation in multiple facets of the students' lives, which may also be an attributing factor for the negative experiences. They did, however, experience comfort, and enjoyed the flexibility and convenience of *home-exams*. These findings build on Yang & Cornelius' (2004) identification of the themes *lack of self-regulation*, *lack of motivation*, *isolation* and *flexibility* in online education. Related themes were constructed in the present study. Previous research revealed that students regard *home-exams* as *convenient*, yet students generally prefer *on-site exams* (Buzetto-More, 2008; Hussain et al., 2020). Similar results emerged in the present study, and the students elaborated on the findings from previous research. The results on this particular topic reflect existing literature (Yang & Cornelius, 2004; Buzetto-More, 2008; Hussain et al., 2020). Since these studies researched students partaking in *online education*, and the period of lockdowns and home-exams transformed the participants from the current study into online students, the parallels are unsurprising.

Considering that *home exams* were experienced negatively by some students, alternative assessment methods, such as *essays* and *assignments*, may be better suited than exams in the context of online education. Hussain et al., (2020) found that students participating in online education suggested a focus on alternative methods, such as oral assessment - instead of traditional exams. Moreover, others have argued that traditional

assessment methods are unsuited for online settings (Iqbal et al., 2022). This seemed to be the case for students in the current study, depending on their individual characteristics.

Strengths & Limitations

Strengths of the current study include that (1) the qualitative and phenomenological approach proved to be an effective method in capturing student experiences. The data produced from the semi-structured interviews was rich and deep. (2) Since the research on subjective experience regarding various digital assessment tools is lacking, this study touches on relatively novel territory - which has previously mainly been researched via quantitative methods. (3) The findings from this study resulted in contextualized student perceptions regarding digital learning, relevant for universities in the Netherlands.

Limitations of the study include that (1) the sample size was small, even for a qualitative study. In addition, (2) the participants lived in the same area and attended the same university. Therefore, limitations in transferability may exist. The small sample size and specific setting did, however, aid in producing in-depth and contextualized results. (3) Critics of *Thematic analysis* pose that the method receives little praise for analysing data. Braun & Clarke (2006) argue that this is because of its poor demarcation in research, even though it is widely used by researchers. Lastly, (4) the initial research design included a heavy emphasis on *alternative assessment methods*. This proved to be beyond the scope of the study. A more focused approach would have resulted in a less arduous analysis process.

Transferability

Considering this study's (1) small sample size, (2) specificity, and (3) qualitative nature, the findings of this study should be used keeping these aspects in mind. However, since a multitude of schools and universities across the globe use one or more methods of assessment discussed in this paper, the results could be transferrable across contexts if the

setting permits it. The findings of this study should prove relevant for students, course creators, lecturers, and other staff members in universities.

Implications and suggestions

There is significant potential for digital technologies to augment and enhance education, including student assessment. Findings of the study are potentially valuable for university policy makers, course creators and researchers. The results of the present study may also provide context and elaborate on previously researched student perceptions regarding digital education, especially concerning assessment. The author suggests that more research should be done into students experiencing various methods of assessment in the context of the digitisation of education. Furthermore, innovators, researchers and universities are recommended to promote innovation in exploring technology-supported assessment in order to close the gap between its potential and the reality. Simultaneously, the strengths of traditional and analogue methods should be recognized and considered.

Taking into account the possibility of prospective lockdowns, student experiences regarding home-exams could provide guidance for course coordinators and universities regarding the development of policy in response to future emergency online education situations. Acknowledging the unpreparedness of universities in the face of the emergency online education that was established during COVID-19 lockdowns, it is commendable that students were able to continue their studies at all. In preparation for emergency online education, lessons can be learned to adequately respond and adapt to the situation. This study contributes to that by revealing student experiences regarding home-exams and other forms of assessment.

Future researchers are recommended to (1) conduct research in different contextual and cultural settings, (2) research different assessment methods, (3) incorporate a larger sample size and (4) pursue a more focused and specific approach regarding topics of interest.

Conclusion

The present study revealed how four students' learning experiences were mediated by digital technologies, in the context of *exam preparation* and *assessment*. Students experienced writing by hand positively, mentioning that it led to better learning. Overall, students showed a preference for pen and paper - if the learning activity allowed it. The ability to keep an *overview* and *navigate* were also important factors in mediating students' *exam taking* experiences. The design of a digital exam was mentioned as an important factor, since the students reported that a well-designed exam assists in providing a positive learning and assessment experience. More innovation in technology-supported assessment is required to enhance, among other things, the ease of *overview* and *navigation* in exams.

Additionally, the efficiency of digital technologies was repeatedly identified by students, in the context of both *exam preparation* and *exam taking*. Cited reasons for this include the speed and neatness of working digitally. The students shared positive experiences on the digital nature of essays, assignments, and essay-based exams. Due to the efficiency digital technologies provide, many essay/assignment-methods are made possible that would otherwise be impractical. These methods had a positive influence on the learning experiences of the students. For example, they promoted a more engaged, prolonged, and active working strategy than traditional exams. This was particularly true for students who were less motivated and disciplined. Overall, student characteristics seem to affect how methods of assessment are experienced.

Home-exams significantly mediated the students' learning experiences, concerning both *exam preparation* and *exam taking*. Again, depending on the students' characteristics, they experienced less stress, more convenience, and more comfort during home-exams. One student, being prone to severe stress, experienced home-exams particularly positively. *Home exams* allowed them to perform better, because of the absence of stress and distractions

involved with *on-site exams*. The remainder of the students experienced less motivation and engagement regarding their studies. This was mostly attributed to the fact that the period of home-exams included social isolation, emergency online education and a lack of surveillance - allowing students to cheat during the home-exams. In the end, traditional examination methods may not always be suitable for online education. The findings of this study build and elaborate on previous research.

Considering the rapid digitisation of education, it is important to identify strengths of *traditional methods of assessment* – and explore the potential of *technology-assisted education and assessment*. Student experiences and perceptions can be of great value in pursuit of this.

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Appendix A

Interview protocol

Topic 1: Examination on site

Lead off question 1: Typical exam in an exam hall

Let's think about a typical physical exam, say the last exam that you have taken. Please take me through all your activities that you remember from the moment you started walking into the exam hall. Don't be shy on the details!

Covert categories: attention/distraction, digital/paper, stress levels

Follow-up questions

- 1. On typical physical exams in an exam hall, could you tell me a bit more about your stress levels that you perceived in the hours upcoming to the exam? Maybe while you travelled to the location?*
- 2. You mentioned "...", could you tell me a bit more about how well you were able to focus and keep your attention during the exam?*
- 3. You said you (E.G.) walked into the hall full of people, could you tell me about any stress you experienced?*
- 4. So, you mentioned... .., could you tell me a bit more about that?*
- 5. Depending on if the exam was done digitally or on paper: You said How did you experience this for an exam that you did digitally on a computer/with paper and pen?*
- 6. Are there any things you can tell me about doing an exam on a screen? How does this influence your experience (maybe compared to a pen-and-paper exam) of doing an exam?*
- 7. Was there surveillance, how did you experience this?*

Topic 2: Home-exams***Lead off question 2: Typical digital exam done at home***

Did you ever have to take a digital exam at home? Could you please guide me through all your activities, as much as you remember, from the moment you logged in to start doing the exam until the end?

Covert categories: attention/distraction, open book/closed book, stress levels

Follow-up questions

- 1. Tell me about before too?*
- 2. You mentioned you were distracted; how well did you manage overall to stay focused on exams done at home?*
- 3. Was the exam open book or closed book? How did you feel about this?*
- 4. You mentioned (E.g.) that you felt comfortable at home, could you tell me a bit more about your level of comfort, stress or maybe anxiety?*
- 5. Were there other people around? How did this influence your ability to take the exam? (Focus, distraction etc.)*
- 6. Do you feel you learn more from open book exams or from closed book exams, if you had them?*
- 7. Was there surveillance, how did you experience this?*

Topic 3: Exam preparation***Lead off question 3: Preparing for an exam***

Let's go back to preparing for an (either digital or not) exam. Could you tell me about your learning activities and other things that you do in preparation of an exam in as much detail that you can?

Covert categories: attention/distraction while studying, preparation pressure, studying strategies/activities, motivation.

Follow-up questions

1. *You mentioned you like to read the slides; how well do you feel this prepares you for exams, in general?*
2. *You mentioned you like to make flashcards(e.g.), could you tell me about any other tools or strategies that you like to use when studying?*
3. *Was this exam done digital or with pen and paper?*
4. *You said you always start studying late for an exam, how do you experience your levels of motivation for exams? → digital or pen-and-paper, do you feel like this makes a difference?*
5. *Same strategy during covid?*

Topic 4: Alternative assessment methods***Lead off question 4: General alternative examination methods***

During Covid or otherwise, have you experienced other examination methods implemented during or at the end of a course, like Slimstampen or Essay questions, instead of a typical exam?

Covert categories: perceived efficacy of information retention, preparation strategy/activities, stress levels

Follow-up questions

1. *Please could you tell me about all the examination methods you were subjected to and about your experiences with them?*
2. *How do you prepare for... (method)?*
3. *You said you liked the use of (e.g., Slimstampen) for learning, how well do you think you learn from this method?*
4. *How long do you feel like you remember things from courses that use (...method)?*
5. *Can you see a relation between digital technologies and learning?*

Concluding questions

1. *Concluding, what method of (digital) examination do you think is most beneficial (to you and/or the rest)? Why?*
2. *Do you think digital examination methods influence the quality and your preference? How/why?*

Appendix B

Thematic analysis report

To answer the question how digital examination and preparation methods mediate the experience university students' learning activities it is important to note that we are trying to look for answers on how students experience digital methods, as well as traditional ones. The themes and that were derived from the interviews touch on two categories: preparation and exam-taking. Exam preparation was mostly mentioned in the interviews by how students prepared for their exams or are incentivized to do so through assignments. Some of the themes have overlap with the other category, such as writing and essay taking. As these are used both in preparation and as an assessment/examination method.

Preference for pen & paper

A recurring theme between all the interviewees was the topic of writing and working with pen and paper when preparing for exams, as well as *doing* an exam. We will first touch and the experience of using pen and paper regarding exam preparation.

Using pen and paper when studying is often mentioned as the preferred method when taking notes, studying, and even summarizing - although it was reported to take a lot of time, was experienced positively and was generally described as more engaging and enjoyable. In the following excerpt P2 is asked about reading and writing when studying:

J: "Do you write a lot, or do you read a lot? You read a lot, you said that. 2: Yes, I do a lot of reading, and I write even more (...) (shows me an example of note block, followed by some miscellaneous commentary) 2: Yes, and when I write by hand I actually learn the most (best). Then I just remember it well.

P2 mentioned they learn and remember material best when writing by hand. Continuing with the following excerpt, P3 was asked about the same thing, mentioning he gets sore eyes from reading from a screen and continuing with the following:

J: It's mainly for how you look at it with your eyes that you...?

3: Yes, and I like writing notes myself so much. Well, there are plenty of studies already been done on it, to um, what effect it could have. Writing and digital typing or whatever. For example, I think that if you use an iPad and you write with such a pen, it might have the same effect, I don't know very well. But I have to say that I spend more time writing something down, so I'm also engaged with it longer.

P3 experiences longer engagement with the material that's being worked on when writing by hand, an effect that he feels might be able to be emulated with an iPad. An interesting remark on how writing is experienced differently from typing when taking notes or studying. P4 gives her own explanation as to why working with pen and paper is their preferred way when taking notes or studying:

J: Do you like that better than on a computer, doing those kinds of things? (writing by hand)

4: yes, I don't really know why, but I like to have it (notebook) with me and write in it. J:

Okay, you don't know why? 4: No, there are actually many more benefits to working on a computer. But, every time, I just don't do it. Even if I try, I will continue the next lecture... again... writing. So, I'm not sure why that doesn't attract me. I can't finish my summaries from the material because it seems too much work."

A recurring trend between the interviewees; they experience writing more positively than typing, even though it takes more time to write by hand. An explanation is not always given why they enjoy it more. It may be habit (as it might be for P4), as well as just a more pleasing experience to them. It is worth noting that all the interviewees were aged 21-25 years old and Dutch, a generation that experienced a lot of digitalisations growing up but for whom handwriting was still the norm in elementary school.

Digital efficiency

Although the interviewees all claimed to prefer handwriting if they had the time and choice, another recurring theme that was constructed concerned how they experienced working digitally as efficient and fast, as well as facilitating more possibilities that are useful in learning, preparation, and assessment. An example can be seen below. P1 explains why they think they think digitally typing out a lot of words is experienced as efficient.

J: (asks about whether essay assignments could be done with pen/paper)

I: Um, no, that's not really contemporary either, it's also much neater if you do it digitally. And some people can't read certain handwriting.

J: absolutely true, can you think of any other advantages that there are that those kinds of assignments are all digital now?

I: typing is faster, when I'm writing (with pen), I have/feel that my head goes faster than my hand. So then my head is already 3 sentences further and then I'm writing down another sentence.

On the topic of both preparation and assessment it is a recurring theme that all interviewees experience typing as faster and more efficient than writing - and it should be no surprise as this is the case for most people that practice both activities. Essays, not technically

being an examination method, are a way of assessment. Therefore, it is still mentioned here considering the participants had so much to say about it. Being able to type when doing open question, essay-based exams and essays is experienced positively due to the efficiency/neatness and speed, as illustrated in the excerpt above.

J: Are those essay questions digital? I: Yes, always digital. J: Does the fact that it's digital affect your learning style strategies? I: Um, well digitally I write faster. Because I am typing. I then have less stress in advance, like okay I really need to know (the material) so I can give a short answer. Because yeah, with pen and paper, um, I can really spend a long time writing something out. Digitally it's less of an issue in advance, and during it too.

In the excerpt above P1 mentions how they experience digital essay-based exams, if they had to write the answers out by hand it would take more time and they feel that this gives her more stress in advance; having to be more concise requires a better understanding of the study material. In the excerpt below P3 also illustrates why they prefer the digital experience of typing when doing an essay-exam below. Besides mentioning that it's faster to type, they also say handwriting can become a mess when answering essay questions on paper - leading to an unsatisfied feeling.

J: Yes, do you think you have a preference? (on doing essay-exams digitally vs pen-paper)
3: Yes I like typing. With the essay questions on paper, handwritten essay questions, it can really become a mess. I am therefore simply not satisfied with an answer purely because it could be that the teacher cannot figure it out. (Laughs). What I wrote down. So I think my preference for essay questions is typing, but I do. Yes, I would like to have an impossible

situation where I have a physical exam, a paper exam in front of me. Then you can type the answer, print it out quickly and then hand it in by hand.

At the end of the excerpt, they express their ideal situation, giving an example how working with paper, even when typing the answers, would be their preferred experience.

The efficiency of digital essays and assignments

In the main theme description we could see how assignments and essays are done digitally in most of the students' experiences. They are generally preferred this way by interviewees as well, due to the efficiency and amount of work it would be to do these by hand. This subtheme goes into a positive learning experience working on (mandatory) assignments and essays. Although assignments and essays are not standard examination methods, they were brought up by every single one of the interviewees. Assignments are mostly used in the context of preparation. Although most that were mentioned were mandatory, they generally had a positive influence on the preparation experience for the interviewees. Essays can be described as an assignment that is also an assessment method. This is the definition that will be used in the report.

Assignments are experienced positively in the context of learning for multiple reasons, as described by most of the interviewees. The mandatory nature of assignments 'forces' the student to start working with the material, starting the learning and preparation process in advance of when the student would normally start actively studying for an exam. As a quick side note: 3 out of 4 interviewees described they take about 7 days or less to actively prepare for an exam. These were also the three interviewees that mentioned the positive experience, or positive impact of mandatory assignments on their studies and performance.

In the following excerpts P3 is asked about how he experiences the digital aspect of mandatory weekly assignments. They mention it isn't a very conscious thought; how they

experience the difference with a digital assignment in their learning activities. They are aware of the how the digital facilitates these assignments, following by mentioning that it forces you to engage with the material on a weekly basis:

J: Yes well, how you experience that, yes. 3: Hmm, I don't really think about that a lot. I think the only difference is that you can just do it in the quiet of your own home. And that it's pretty chill that you just... Look there is a deadline, but there is about a week to meet that deadline. But you also have a whole week to engage with the material for a few more hours. J: I see. 3: ...And I think the digital aspect facilitates that.

3: (Summary: tells about online weekly assignments that he experienced positively)

J: and how well did you learn from that? In your experience?

3: Yes well better than normal, because normally I don't. Say, I'm a person who reads during the block but doesn't necessarily study during the block. I read and I come to lectures, and I do all that. So the knowledge does stick, but I just engage with the material a bit less than in this case, than in Tassos' case. Because, he made sure you had to hand something in every week, and so every week you were going to read up on the material. And every week you had to come up with a new answer to a question you had never heard, so that was kind of chill(relaxed/nice).

The mandatory aspect of the assignments forced P3 to engage with the material, this was experienced quite positively in the context of learning and preparation. These experiences appear to be *mediated* by digital technologies, because essays and assignments are often *facilitated* by the *efficiency* of digital technologies.

The following excerpt below from interview 1 shows how P1 talks about how they experience longer info retention from doing essays than from exams. Jumping ahead to assessment, we can see there is an overlap with preparation here. They even still remember everything from a poster-making assignment. They said to enjoy this, which is probably a reason for the extra engagement and motivation.

J: yeah okay, but what does that do for your long-term memory (how well and how long do you remember it), with the study material for you? 1: Um, I remember more about the material of essays than from the exams I did. I remember, I made a poster about addiction 2 years ago, I basically still remember everything about that.

P1 almost always starts studying very late so it maybe is no surprise that they experience better recollection of the material they worked on for assignments and essays – they started studying 3-4 days in advance of an exam, versus mandatory assignments or essays that require a more engaged and active working strategy.

J: Exactly, is it also easier... what do you find easier to commit to... Just learning/stamping or one of those alternative methods like essay or essay questions?

4: Uhm usually I find it easier to write an essay, to commit to starting that. Unless I need to read 15h of literature first. But usually after 1 article, you can just write a bit. So that's a bit better of a prospect than studying clinical psychology terms for the next 3h.

In the excerpt above P4 illustrates how they find it easier starting to work on an essay than to study/stamp definitions in preparation of exams. An experience and perception that is shared among other interviewees.

We might say and interpret that digitalisation is facilitating the experience of efficiency and speed when working with assignments and essays for the interviewees. These active and deep engaging learning activities necessary for these types of assignments could be achieved with hard work by the student without the assignment/essay, but it is provided in an efficient manner by the digital assignments and essays. Assignments and essays may also require less intrinsic motivation and discipline from the students, as part of the planning and structuring is done for them.

Navigation and overview differences

This theme will touch on how the experience is mediated between overview and navigation depending on if an exam is taken digitally or if it is taken with pen/paper. The definitions for overview and navigation used is how well one can see and interpret the relevant exam, questions pictures etc., as well as the ability to backtrack and navigate oneself whilst taking the exam. All interviewees had something to say about this. As an important note: digital exams include both home-exams as well as digital exams on-site.

Starting once again with the experiences on paper exams, experiences and attitudes concerning navigation and overview are not as pronounced and the students generally had less to say about this. All interviewees were the most vocal on the difference in experience between typing and writing. For some participants, the difference between a digital MC-exam where backtracking to previous questions is allowed and a paper MC-exam reportedly was minute, or they were unaware of it. See the excerpt below:

J: I mean how is it to have things (the exam) on paper in front of you, vs being able to fill it in digitally with a screen on location?

4: Um I don't really feel like I see a difference between that. You just can't take notes, I guess... for statistics I would have found it annoying.

Besides being able to take notes when the exam is fully digital P4 experienced little difference between paper and digital exams. Later they explain how they see the difference in navigating MC paper exams vs MC digital exams as: *“Then it’s just whether you colour in or click on balls.”*

In the excerpt below P1 explains how they experience no difference for focus or distractibility doing an exam on a screen/digitally. The ability to write/draw on the paper in some exams is experienced positively by them.

J: But do you also notice, in your experience, any difference in focus or distractibility when you do it on a screen?

I: Um, no that also depends on how well I know the material. I don't think it necessarily makes a difference to me whether it's with pen and paper or on a screen. I do have with maths questions, for example, then I do like paper better because then I can write everything out and draw it, digital doesn't necessarily allow that.

The next excerpt below illustrates the experience of navigating an exam for P3.

J: If you were to do it on paper, if you could think of an example of that, of what that was like. Does that have any impact on your focus or how well you can keep your attention?

3: It's not a conscious thing at least. I think there probably is a difference, but not necessarily in my experience.

J: Okay, so you've never really thought about that before?

3: No, I was... the 1st time I took a digital onsite exam versus a paper version of an onsite exam, I felt that... I felt that on the computer it was a bit less clear (had less overview). J:

Okay. 3: Because I just really like having paper in my hands. And you think "okay I want to go to page 3 now!" Flump, you're on page 3. And on the computer, it's "oh yes it's this question shall I then, oh no that's the wrong question, should I go back... oh yes..." It's not a mega (big) difference or anything. But I just find it nicer to work with paper, that's my personal preference.

P3 is not very consciously aware of a difference on their focus of attention for digital vs paper exams. They too mention here that the digital ones tend to be a little less clear, or had less overview, compared to the classical paper exams where you can just flip the page and scroll back.

The following excerpt from I2 sheds light on their experience taking MC-exams on-site, as well as note taking during the exam:

J: Okay, you were never able to go/scroll back at MC exams on location?

2: I did in my entrance exams, a long time ago. Yes that was fine too, because there you also had an extra piece of paper where you could take notes. So then you could also keep an overview. Yes, if you can track/scroll back (to previous questions), digital is not really a thing, but if you can't go back then I clearly prefer printed versions.

P2 is clear on their experience. If a digital exam is well designed - preferably with a paper to take notes on - and allows backtracking to previous questions, it is not a big issue. Once again, people like to write for overview or out of habit, tying in with our first theme.

Comfortable and disengaged during home exams

Starting with home-exams it is important to note that these were a forced necessity to allow students to continue their students even during the COVID-19 pandemic lockdowns.

They were included in this study because it is a good and unique opportunity to gain insight into the experience of students taking exams in locations beyond the standard exam hall. It is the final theme that will be brought up to answer the research question.

Starting with exams taken at homes, or home-exams, a first important note would be to say that this drastically changed the way of dealing with exams and the preparation for some interviewees. One of the participants has a special arrangement with the university of Groningen due to them being prone to severe stress and blackouts when there are distracting stimuli around. P2 takes a lot of exams at home where others do them in exam halls, or they take them in a room with only one surveillant and with no other students. Their story is a prime example of how the presence of others can lead to stress and impede performance on exams; home exams are very positive for their learning experiences. Regarding this, P2 explained: *“Because I have a separate arrangement that I can’t be in a room with 500 students due to distractions (...) I was there but I just couldn't think straight anymore. I couldn't think of anything anymore and execute the right steps... (...) look this doesn't happen, for example, in an online exam at home.”* Being very susceptible to stress and distractions, *online home exams* were a way for Lisa to take exams with reduced stress – which was of paramount importance for their ability to perform on exams.

The experiences of the rest of the interviewees are very different, in summary; they said they treated all home-exams like open-book exams, learned a lot less from the period of home-exams, felt more isolated or had less ability to stay focussed in their own homes. On the flip side, most of them felt quite comfortable in their own environment. In the end however, home-exams were not very positive for their learning experiences.

An example of how P1 mentions they get distracted by their environment during a home-exam can be read below. similar stories were told by the other interviewees. The own environment was sometimes a distraction:

J: Were there things that bothered you in home exams that might not bother you in exams in a hall for example?

I: Well um, I was just sitting in my own room at my desk. And it was kind of full of all sorts of things. So, basically, yes, again it depended on whether I knew the material well or not. If I didn't know the material well, I would go and look around and think, hey, nice (...) I need to finish doing that thing!

Whilst we were talking about distractions during home-exams. P3 made the following remark - illustrating further how one's own environment has a big influence on their activities and distractions during an exam.

3: I have even gotten up during an exam to make a cup of coffee or smoke a fag. I have sometimes smoked a fag in my room during an exam, for example. Those are also distractions you know....

The ability to smoke, drink or go to the toilet was mentioned often as a comfortable experience. As mentioned by P1:

J: ...and you felt, you said you had just grabbed some nice food... coffee. Might I say you felt comfortable?

I: Yes indeed, I was just sitting in my pyjamas with a blanket, hot drink there. (laughs).

This is not to say that the home-exams had a positive influence on their learning experience. Besides P2 all the interviewees say they learned a bit less or little from the home-exam period. Reasons given for this are mostly: the ability to cheat, less engagement and less motivation. The lack of a social aspect during home studying and exams is a reason given by P3 for the decreased engagement:

*3: I think overall I learned less during the time when there were online exams than on-site exams, and I think for me that was purely due to the fact that I was less engaged with my education, because before the lockdown came, there were lectures on-site, and then I thought oh! I have a lecture let me go there, because I'll see people I like again, and I can talk to them during the break and afterwards we can discuss the lecture, and we can go for a drink afterwards with I don't know how many of us, we can all go to the UB. That was fucking chill (nice), really, I could just really appreciate the social aspect of studying. And that just completely went away during lockdown, so I just didn't feel like it anymore. And so I just learned less during the lockdown than before, **especially** before.*

Digital technologies allowed students to continue studying where this would otherwise not be possible, or a hazard to public health. In this sense it is good thing students were able to continue their studies in some form. P1 also had negative experience following the year of home-exams; the ability to cheat and not being motivated to study properly had them struggle developing adequate studying strategies. A telling example of how one's studying strategy and examination method can lead to a year where it feels like less was learned or remembered from the taken courses:

J: Right, so, did it maybe, for a while, you didn't have to apply studying skills, did that maybe bother you a little bit? That you had to get used to that again?

I: Um, yes. Because the subjects in year 1 were relatively very easy. And actually, I should have actually used year 1 to have to develop those study skills. And I didn't have that, and I didn't do that. So, in year 2, um, I did notice very much that I didn't know how to study.

The ability to cheat made the period of home-exams less stressful for the students. P4 explained their exam-taking strategy as follows: *“I treated them all as if they were open book exams.”* For clarification, consulting study material during *home-exams* was considered fraud, unless specifically stated that it was an *open book-exam*. In general, the students felt comfortable during *home-exams*. P2 enjoyed utilising the facilities their home provided, for example: *“I also sometimes went to the toilet. That was really luxurious.”*

Ultimately, three out of four students said they learned and remember less from the period of home-exams.