UiA University of Agder

Flipping the Sound Laboratory

A Rehearsal in Audio Education

Konstantinos Kokogias

Supervisors
Kåre Mosgren
Morgan Konnestad

This master's thesis is carried out as part of the education at the University of Agder and is therefore approved as a part of this education. However, this does not imply that the University answers for the methods that are used or the conclusions that are drawn.

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Faculty of Engineering and
Science Department of ICT

Preface

Through my professional experience, I have come to realise that sound is some sort of mystery for many content creators, whether amateur or professional. I have witnessed too many situations where established videographers plan meticulously their framing shots before filming, then plug-in a microphone somewhere just before pressing the record button and forget about it. Afterwards, typically an email or SMS would arrive to my inbox with a sentence such as ¨problems with the audio, can something be done? ¨. Then, I would give my typical response in the lines of ¨maybe..it depends..recording a source correctly is important you know¨ - or I would use a sentence from my days working with some rather demanding clients in the private sector in London, ¨I am a technician, not a magician¨. Therefore, the core motivation behind the study area of this master thesis was to investigate a different type of education support for people who work with audio, but not have it as a primary focus in their multimedia product.

The thesis title contains a keyword which is central in this study, that is `rehearsal´. I have previously witnessed students in the sound studio/laboratory that this thesis is concerned about, looking rather terrified when they turned up a gain knob on a microphone amplifier, giving the impression that they thought something would explode. The sight of several (and rather expensive) hardware units which are interconnected looks indeed overwhelming for many novice users. From my personal experience, I would say that it can create some sort of psychological burden on some students. These types of students were central in my thinking process for this project, could some extra preparation and gradual exposure to the studio help? The thinking sequence behind the hypothesis and the research questions in this thesis was that if someone knows, or *believes* to know something, then he or she *does* something, because he or she *feels* that they are able to do something.

I would like to thank my supervisors Kåre Mosgren and Morgan Konnestad for aligning my efforts during all stages of this thesis (their uplifting sense of humor strikes a chord with my intrinsic motivation). A special thanks to Kåre Mosgren for permitting his course to become a research subject, for the `norwegification´ of learning material, and for the provision of voiceovers, among other things. Also, a thanks to Rune Andersen, Elen Instefjord, and Christian Simonsen for valuable input. And of course, a great thanks to the participating students for giving their time to me and for providing invaluable feedback.

Lastly, I would like to thank my biggest two motivators in life, my father Vasileios and my son Aleksander Vasileios, for teaching me how to think in new ways.

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Abstract

Sound is an integral part in a multimedia production, however, obtaining audio recordings for professional purposes is a confusing process for many content creators. In the modern era of `one button´ solutions, an increasing number of people are able to produce visual material of good quality. However, in many cases sound is perceived as `just being there´, and paradoxically quality becomes noticed only when it is compromised. A characteristic of audio related work is that it is often difficult, if not impossible, to restore sound that was recorded poorly in the first place. Therefore, it is crucial to have a good understanding of the basics in order to capture an audio source in good enough quality to qualify for further processing in the editing room.

The University of Agder offers a dedicated audio course to the bachelor students of the multimedia technology and design study program on campus Grimstad. In this course, the students have the opportunity to record sound in a studio of professional standards, however, experience has shown that many feel perplexed and overwhelmed at the sight of several pieces of audio equipment which offers a variety of routing and processing possibilities. Learning and instruction in the studio has traditionally taken place through face-to-face verbal dissemination, however, poor engagement from some students during group work pointed to issues with information processing and motivation.

This thesis investigates whether a flipped learning digital resource could improve student engagement, by preparing them in advance of their participation in a physical introductory studio session. The hypothesis of the study was that students who participate in a flipped learning model end up having a better user experience in the studio than students who learn traditionally, as they feel more competent, thus confident, to engage. Two study groups evaluated their experience in the sound studio through an established tool, which was used as the basis for answering two research questions that were linked to the hypothesis. The data that was generated was correlated with other forms of data, in order to analyse the results within a sociocultural theorical perspective, in conjunction with theories that relate to memory and motivation.

The results showed a significant statistical difference in favour of flipped model students regarding their learning experience in the studio, hinting improvements in retention of information and motivational levels. The study concludes that there are positive indications that a flipped learning approach can improve engagement in an audio laboratory, however, the students´ distinct learning styles and diverse motivational orientations should be taken into account by course designers, by facilitating for enhanced flexibility and connectivity in digital resources among other things.

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Chapter 1

Introduction

1.1 Problem statement

Audio education delivered from the premises of an academic institution, combines theoretical lectures given in a classroom, with practical laboratory sessions in a recording studio. These sessions provide the students with valuable hands-on experience in real-world scenarios, as they get exposed to professional equipment and common technical challenges. Troubleshooting skills are a vital element of sound studio work and requires a good knowledge of available tools and technologies in order to solve problems quickly (Vandemast-Bell et al., 2015). However, inexperienced students face a high learning curve in the limited time they can spend working in a studio, resulting in pedagogical challenges for audio educators (Eidsheim, 2009; Voss, 2016). Understanding and implementing correct signal flow, from an audio source to one or several outputs, can seem intimidating in the hardware domain (Fisher, 2021). The advent of internet-based instructional videos from providers such as Lynda and YouTube can provide significant assistance to students (Snyder, 2017), however, it cannot apply to all cases as ¨some aspects of recording studio operation involve specific knowledge related to recording studio infrastructure¨ (Voss, 2022, p. 24).

The audio course DAT-228 at the University of Agder (UiA) on campus Grimstad utilises a recording studio of professional standards for the needs of its practical sessions. It is a custom multichannel solution which integrates a range of hardware and software components. The students are expected to use the studio to record voice and foley material for their practical assignments in the audio course, as well as assignments in other courses in their multimedia bachelor study program that require sound, such as the video and the 3D-modelling and animation courses. Students need to master certain skills for the overall needs of a recording session, with the main ones being setting up microphones, routing audio signals through hardware components, using audio software to record and to export material, and providing monitoring to multiple outputs. To get to grips with the complexity of the studio and get approved to use it unsupervised, the students must attend an introductory face-to-face session with a laboratory teacher/instructor. The session lasts for two hours, whereby the teacher would initially explain and demonstrate the equipment to the students, and subsequently allow them to perform tasks for testing purposes.

Throughout the years that the audio course has been delivered at UiA, physical space constraints in the studio have created specific challenges to the educators regarding the introductory session. As it is impossible to fit the entire class in the control room and do one demonstration in a single session, the alternative has been to create smaller groups of 4 to 5 students and have each group completing its session and training in separate allocated slots over the course of a few weeks. Audio education researchers such as Bassett (2021) have been

critical on gathering several students around equipment in an audio control room for the purposes of a demonstration, claiming it is not optimal for learning and facilitation of critical listening skills. Imsen (2020) advises caution in the use of observation learning due to problems with student concentration, as not everyone is able to remember to the same degree what a teacher demonstrates. Lankford (2021) as well as Loveys and Riggs (2019) bring to attention issues with view obstruction in an active learning space.

In an interview with the thesis author, the audio teaching staff at UiA mentioned that they experience certain challenges with the traditional implementation of the introductory laboratory sessions. The biggest challenge is uneven participation from student group members, where some tend to take a passive role in the sessions, or reversely, more competent students dominate their group. It has been understood that students who are more withdrawn end up forgetting the basics in relevant studio operation. This learning gap can manifest itself as lack of confidence and can put pressure on resources, due to callouts for assistance when these students return to the studio to work unsupervised. Motivational issues have also been cited as a potential contributor to the challenge, as some students feel bewildered when they see several studio components being interconnected in the same space.

The author cross-checked the feedback from the teachers with feedback from the students and found common ground. Themes that emerged from this process were that some students struggled to remember the instructions they had received during their introductory course, that they felt rather overwhelmed by the plethora of equipment and settings, and as a result they did not perceive themselves to be competent enough to work in the studio unsupervised. With no technical support available to assist in the studio after 4 o´clock on weekdays, and all day during the weekends, the workflow for course assignments can therefore be compromised.

Following the feedback from staff and students, the next step was to investigate an alternative pedagogical approach to the traditional face-to-face teaching and instruction model.

1.2 Area of research

Combining increased support for learning with efficient use of resources is perennially relevant from an educational and organisational perspective. Based on the challenges that were mentioned in the previous section in connection to traditional synchronous teaching in the studio, the author wished to investigate whether an asynchronous solution could improve retain of information in connection to lower-level learning. An approach would be to provide instructional material in a format which would allow the students to revisit it.

Flipped learning is a pedagogical model which switches around face-to-face teaching with homework, by which the student normally receives instruction through videos prior to attending class (Frydenberg, 2013; Kerr, 2015). Since flipped learning shifts lower-level learning experiences outside of class time, it then frees up more in-class time for active learning (Eppard & Rochdi, 2017; Honeycutt, 2016), where students learn by performing tasks. A key assumption was that if instructional material was delivered to each audio course

student prior to his or her introductory session, then presumably everyone would be at close levels of knowledge when they met up in the studio for their practice. Consequently, the teacher´s role in the sessions would shift to one of a guide, concentrating on addressing details which relate to more advanced knowledge. As Martin (2021) states, it is more useful if teachers use their limited time with students to provide instant feedback on activities.

1.3 Literature review

Table 1.1 shows the online databases that the author consulted in search of recent publications on flipped learning in audio laboratory education. The search included relevant field areas such as music technology and engineering.

Databases	Audio Engineering Society (AES) journal, IEEE Xplore, Google Scholar, Oria, Web of Science, Aura, JSTOR, SAGE journals, British Journal of Music Education
Main keywords	¨flipped learning¨, ¨flipped classroom¨, ¨video-based learning¨ AND ¨audio education¨, ¨audio course¨, ¨sound studio¨, ¨music technology¨, ¨engineering¨, ¨laboratory¨, ¨multimedia¨
Period	2014 -
Type	Peer-reviewed articles, books and book chapters, conference proceedings
Language	English, Norwegian

Table 1.1 Search criteria regarding literature review

Although ample research exists on flipping theoretical parts of courses, limited research can be found on flipping laboratory parts in audio education as well as related areas. Furthermore, the majority of this research is primarily concerned with specific studio components and/or tasks, rather than comprehensive `A to Z´ processes i.e., from rigging for a recording session, to recording and exporting.

Bassett (2021) created a digital photo-realistic console simulation for the Audient ASP4816 model which is widely used across the global campus network of SAE Institute. The purpose of the solution was to flip face-to-face demonstrations by audio teachers in the recording studio. Emphasis was given on providing the students with a realistic image of the real-world equipment in order to provide context and to motivate. The students could familiarize themselves with the equipment in advance of meeting up in the studio for the first time. Students benefited from the simulation through interactive tutorials and assessment elements which ensured that they could demonstrate basic operational skills of the console prior to getting their hands on the physical model. The simulator was publicly released and had a large appeal to users. However, the pedagogical effects of the solution were not systematically evaluated, and no data on its effectiveness exists beyond anecdotal reports.

Fisher (2021) took audio simulations a step further by developing signal flow training in virtual reality (VR). The 3D space provided by a VR headset could provide a sense of immersion to users, however, a major downside of the solution was the introduction of motion sickness and fatigue. Sickness is a common problem encountered in VR environments when users wear headsets for a lengthy period (Chang et al., 2020). These disadvantages can have a negative effect on learning as students can be distracted from their tasks. Thus, the researcher advocated the use of a 2D interface in the early phases of learning. User data from the solution was combined with an evaluation survey by educational users which showed high acceptance rates. It was reported that 63% of students were better prepared for face-to-face audio laboratories after using the resource in advance.

Music technology education is closely linked to audio education due to the use of similar studio equipment and techniques. Urgilés et al. (2019) implemented a flipped learning model for a music technology course that focused on learning skills in a digital audio workstation (DAW) using Ableton Live 9. Survey data from the students indicated an improvement of perceived competence, however, the study sample was low. In addition, the study had limitations regarding the implementation of face-to-face sessions due to inadequate group-oriented activities. The designers of the flipped learning resource pointed to the importance of good skills in producing audiovisual material, so to create a distraction-free learning environment for the students.

Voss (2022) developed a step-by-step resource for mobile devices regarding recording techniques within music technology education. The resource provided support in various tasks, from DAW configuration to headphone patching, signal flow, and operation of outboards. Certain design principles were identified to support learning: task-specific and concise information, contextual and visual learning material, diversity in learning approaches, and integration of learning tools. The importance of keeping learning material concise by avoiding prolonged explanations was emphasized, as well as using visuals that minimise cognitive overload, and incorporating the resource within other educational resources. The study concludes by recommending the investigation of interactive and immersive environments where learners would be able to click directly on devices to receive information.

Looking beyond audio and music education, Troya et al. (2021) reported on the advantages of flipping laboratory sessions in an undergraduate computer science course. The study was centred on moving introductory face-to-face laboratory instruction to videos, and the researchers applied five principles in the production of video learning material: duration was kept short, it was recorded in informal settings, it featured the actual course instructors, it had good quality, and it took notice of preproduction values. Students needed to watch the videos in advance of their scheduled face-to-face sessions, and a consequence was that more time became available for active learning activities. Under a traditional learning model, up to 50% of laboratory time was consumed on teacher explanations. The study compared the flipped model to the traditional model and results showed a positive correlation between grades and engagement with the flipped learning material. An interesting finding was that there were

fewer students with lower grades following the introduction of the flipped model, as the researchers reported that students who struggled to keep up with the pace of the course, they had the benefit of revisiting instructional material. Overall, there was a clear acceptance of the flipped approach with 90% of participants preferring it over traditional learning.

Loveys and Riggs (2019) used a variety of learning content for flipped versions of laboratories for two undergraduate science courses in animal and plant biochemistry, as well as microbiology and invertebrate biology. In addition to videos on theory which featured the course teachers, they also included demonstration videos, animations, PowerPoint presentations, quizzes, and interactive elements. The study claimed that the participation of the course teachers on videos had a positive impact on student attention. The flipped laboratory design was based on a template from Karanikolas et al. (2016) which allocates principles from Bloom´s Taxonomy (1956) on pre-class, in-class, and post-class activities. The pre-class activities concerned the two bottom concepts in Bloom´s taxonomy, which is *remembering* and *understanding*. Later in-class activities related to the higher-level knowledge concepts in the taxonomy, such as applying previous information and connecting it to other pieces of information (*analyse)*. Interactivity played a significant role in Loveys and Riggs´ study, as results showed that for 79% of participants it increased engagement. Data over a period of six years revealed that failure rates in both courses were drastically decreased, indicating that flipped learning can support students with lower performance.

1.4 Digital resource

The core component of the flipped model is the digital resource(s) which provides `anywhere and anytime´ learning, instead of traditional learning that is limited in place and time. Chapter 2 of the thesis looks into the design and development of a so-called artifact, which had as objective to address the challenges that were described in the problem statement section. This process was part of a framework presented by Peffers et al. (2007), called Design Science Research Methodology (DSRM), which was used as a reference in the implementation of this research project.

The design of the artifact was guided by the feedback that the author gathered from the teaching and student sides, combined with some of the main principles, elements and recommendations that were stated in the literature review. The general direction of the design process was that the artifact should cover a voice recording studio process through a realistic environment which invites for interactivity with the user/student. Dealing with cognitive overload by regulating the flow of information was one of the artifact´s main practical objectives, which could potentially improve retention of information, and consequently competence and engagement. In chapter 4 of the thesis, we see how the artifact was deployed in the audio course for the purposes of this study, while in chapter 5 we see how its impact was measured and evaluated by the students in connection to work in the sound studio.

1.5 Factors affecting learning in laboratory settings

Group work in a practical environment such as the sound studio, naturally implies that learning takes place through social interaction. Students acquire knowledge through verbal communication between themselves, as well as with a professional who knows more than them. In addition, they also learn through interaction with the available objects in the laboratory. This interaction requires some level of focus and interest, and demands from each learner to identify and process important information that needs to be retained and reused. It is self-evident that when one learns, he or she *remembers* a piece of information that was previously encountered, and that some level of attention was paid to that information. However, as we will see in the analysis of results, the students had contrasting perceptions of similar and shared experiences. Theory that focuses on different types of motivation attempts to explain these differences. Chapter 3 of the thesis presents relevant theories that relate to the use of a digital artifact, in the context of flipped learning in audio laboratory education.

1.6 Hypothesis and Research questions

The literature review in section 1.3 indicates that a flipped learning model in educational laboratory work can improve areas such as perceived competence, and it has high acceptance among students. With traditional teaching being removed from the laboratory, extra time is given to students to work actively on the topics they have seen in advance. This research project bases its foundations on the information given in the literature review and creates assumptions in an audio laboratory learning context. A key assumption is that a higher level of engagement in a complex technical environment such as the sound studio, is linked to higher levels of belief in one´s own competence, which in turn is linked to higher motivational levels. Flipped learning prepares the students in advance and therefore, a student who shows up prepared, feels more competent because he or she knows, or believes to know, what to do. This results in a better user experience in the practical environment one interacts with due to increased engagement with its tools. A student who is more prepared, remembers more, participates more, feels included and enjoys learning activities. Based on these assumptions, the following hypothesis (H1) was formulated for this research project:

Audio students who participate in a flipped learning model, have a better experience as users of a sound studio, as well as experiencing higher levels of perceived competence, compared to students who participate in traditional learning.

Two student cohorts who enrolled in the audio course DAT-228 would provide data in connection with the hypothesis. One group being students from 2021-22 who learned through traditional face-to-face teaching (the control group), and the other being students from 2022-23 who learned through a flipped learning artifact (the experimental group). Supplied data would then answer the following two research questions:

Research Question 1:
Is there a significant statistical difference at $p < 0.05$ in favour of flipped learning students, in terms of their experience as users of the sound studio?

Research Question 2:
To what extent is flipped learning a satisfactory solution for the audio laboratory from a class perspective?

1.7 Outline of the thesis

This chapter introduced the problem statement that formed the basis for this master thesis, followed by the area of research which will attempt to address the problem. Then relevant literature was reviewed, which has provided useful background information in regard to the design of a digital learning artifact, as it will be explained in the next chapter. Chapter 3 presents relevant theories that provide context to the use of the resource, from a practical and pedagogical perspective. Chapter 4 deals with methodology, in connection to the hypothesis and research questions in this thesis, while chapter 5 presents the results from the data gathering process. Finally, discussion of the findings and conclusions are presented in chapter 6.

It should be noted that although this thesis uses terms and methods which are closely associated with the field of human-system interaction, its focus is not on practices such as usability tests or diagnostics in connection to design improvements. The instruments and methods that have been used in this study were solely for the purpose of investigating the behaviour of the students in the laboratory in connection to the pedagogical approach they were related to.

Chapter 2

Digital artifact

This chapter provides details of the digital resource that was designed for the learning needs of the experimental group during the fall semester for the 2022-23 academic year. The development of the resource was based on Design Science Research Methodology (DSRM) by Peffers et al. (2007). DSRM is a six-step process, shown in table 2.1, which begins with the identification of a problem, then moves on to the design and use of an artifact which has as purpose to address the problem, and concludes with the public dissemination of the process. A central process in the DSRM is the creation of ¨a purposeful IT artifact to address an important organizational problem¨ (Hevner et al., 2004, p. 82).

Step 1	Identify Problem and Motivate	*Define problem, show importance*
Step 2	Define Objectives of a Solution	*What would an artifact accomplish?*
Step 3	Design and Development	*Artifact*
Step 4	Demonstration	*Find suitable context, use artifact to solve problem*
Step 5	Evaluation	*Observe how effective and efficient, improve design if possible*
Step 6	Communication	*Scholarly and professional publications*

Table 2.1 The DSRM. Adapted from Peffers et al. (2007)

As part of step 1 in the DSRM process, the author gathered information from the audio course teaching staff and the students in order to form an idea of the challenges they faced in the audio laboratory. In step 2, the main objectives of the artifact would be to provide support to the students towards retention of information and improve user experience in the studio through increased engagement. According to Peffers et al., the objectives of a solution ¨can be quantitative, such as terms in which a desirable solution would be better than current ones, or qualitative, such as a description of how a new artifact is expected to support solutions to problems not hitherto addressed¨ (2007, p. 55). This chapter provides details regarding step 3, which is the design and development of the artifact. Steps 4 and 5 will be addressed in later chapters of the thesis.

As mentioned in chapter 1, video is a core feature in the flipped learning model (Frydenberg, 2013; Kerr, 2015). When the control group of the study provided feedback on their experience of the studio as briefly mentioned in section 1.1, they did so though comments in open-ended survey items. The insight that was provided revealed challenges relating to memory, and exposed feelings of being overwhelmed at the sight of studio components. The author analysed these student comments by creating an affinity diagram during the process of defining challenges, in advance of generating a design solution (Lucero, 2015). Affinity diagrams are a technique ¨for exploring data, identifying themes, and looking for an overall

narrative¨ (Sharp et al., 2019, p. 323). Appendix A presents the data from the open-ended survey items. Some relevant examples are from student 7 in relation to item 2 regarding studio complexity, ¨a lot of equipment that I am not sure how to use, and do not use it enough to remember everything¨, while student 10 wrote, ¨ why are there that many buttons and switches compared to our use cases (only using a studio microphone) ¨. In relation to item 4 regarding the need for technical support, student 9 wrote, ¨I do not remember everything after the first supervised session..¨. In connection with item 8 which investigated in the studio is awkward to use, student 19 wrote ¨with supervision it was ok to use the studio, however, since training was a long time ago, it was difficult to remember when it came to using the studio ourselves¨.

On another multiple-choice survey item, the control group provided feedback on how learning in the studio could be improved. At that point, the students had finished their participation in the audio course. The choices on that survey item were drawn from previous anecdotal conversations with the audio course staff and the students. As shown in figure 2.1, a step-by-step guide was a first choice, followed by training videos. That feedback aligned with anecdotal feedback from the teachers and gave an indication to design an artifact which would include both choices.

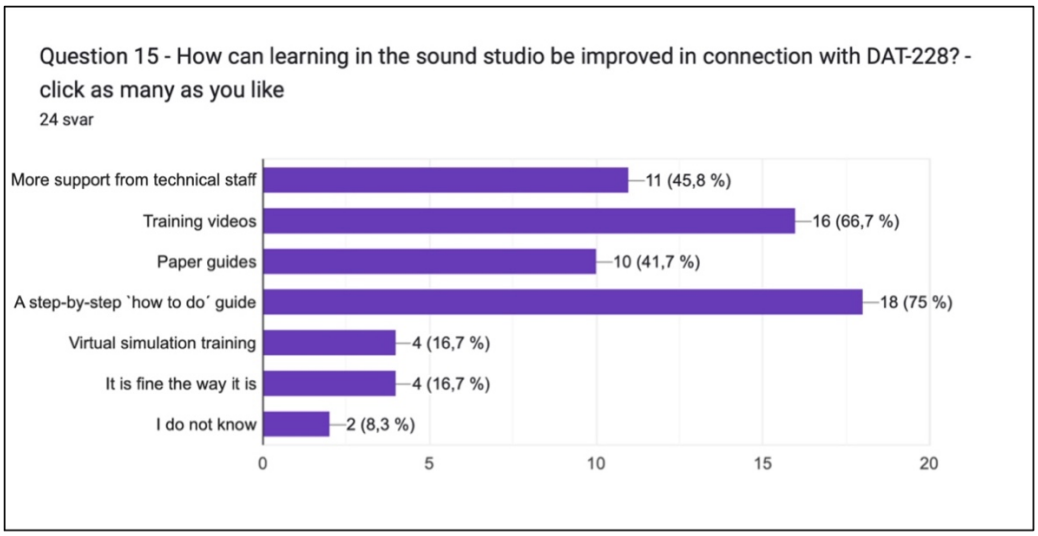

Figure 2.1 Feedback from the control group on improving learning in the sound studio

The author has professional experience in video and audio, and therefore assumed responsibility for the production and editing of instructional videos that the experimental group could watch in advance of their laboratory sessions. The author was also familiar with the learning content of the studio sessions due to previous involvement as a laboratory teacher in the audio course. Using that familiarity as a guide, the author divided the learning material for the artifact into five thematic areas, shown. The themes would be presented to the students in the sequence shown in figure 2.2, reflecting the order of instruction in a traditional face-to-face laboratory session.

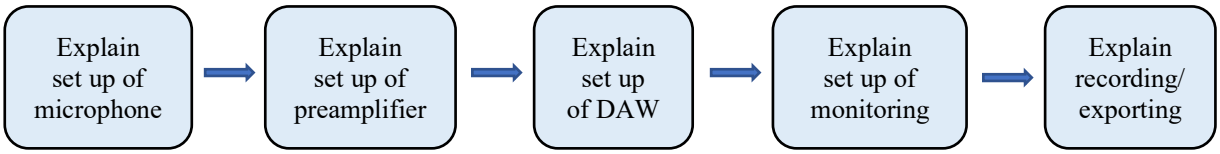

Figure 2.2 Conceptual model for sequencing instructional material in the digital artifact

2.1 Pre-production

After the instructional themes were identified, the author developed scripts for a video for each theme. The scripts were written in English and then approved and adapted to Norwegian by the audio course teacher, as it is the language of instruction in the course. In a broad study by Guo et al. (2014) regarding video production principles that affect student engagement, qualitative data from video producers at the Massive Open Online Course (MOOC) provider edX showed that the pre-production phase has a major impact. Voss (2022) states the importance of keeping information concise and relevant, in order to strengthen student engagement by minimising frustration and fatigue caused by viewing lengthy material.

With these guides in mind, the author focused on writing scripts that would convey information in a brief and clearly expressed manner. For that reason, the third *(explain set up of DAW)* and fifth *(explain recording/exporting)* videos were divided into two parts. Therefore, in the end the author produced scripts and storyboards for seven videos, with words per video (in Norwegian) ranging from 164 to 504. Average word count per video was 314 words.

2.2 Production

The production phase took place in the summer of 2022. Drawing from own professional producing experience as well as advice from the literature, the author deemed that good image and audio quality, as well as visual variety, were important factors for supporting viewer interest and engagement. It was decided that the videos should blend action filmed in the studio facilities with screen recording from the DAW and relevant graphics that would support further the dissemination of the learning material. Production values that were applied concerned noise-free audio quality and good lighting conditions, in order to eliminate potential distractions for the learners.

Long et al. (2016) did a study which investigated student perspectives on engaging with learning material in a flipped learning context. A conclusion was that videos which feature the actual teachers of the course they relate to, create the most engagement with the students, over alternatives such as YouTube (when not featuring the actual teacher) or voiceovers over graphics. Loveys and Riggs (2019), as well as Troya et al. (2021), supported this approach in their studies on flipping laboratory learning. As shown in figure 2.3, the subject teacher of the audio course appeared in the videos, using the actual equipment and facilities that the students would be required to use for their learning, thus `humanising´ their online experience. The teacher also provided high-quality voiceover recordings where he explained the studio concepts that were delivered in the resource.

Figure 2.3 Screenshot from video 1 in the digital artifact resource for DAT-228

2.3 Post-production

The author edited video, audio, and graphics in Adobe Premiere Pro, Adobe Photoshop, Logic Pro, and Microsoft PowerPoint. In addition, some few images were downloaded from the internet (Colourbox), mainly for aesthetic purposes.

Guo et al. (2014) pinpoint to their comprehensive data on student viewing habits from MOOCs that videos which last for less than 6 minutes produce the highest engagement, as dropping rates increase on longer videos. All seven videos that were produced for the digital artifact took notice of these findings. Table 2.2 gives an overview of the seven videos that were produced.

Video	Theme	Duration
1	Set up a microphone in the live room	02:24
2	Explain relevant functions of a preamplier that the microphone has been plugged into	02:25
3a	Set up a project in the DAW in Logic Pro which receives signal from the preamplifier	02:39
3b	Set up a project in the DAW in Adobe Audition which receives signal from the preamplifier	01:41
4	Explain functions of the monitoring unit which sends audio to several outputs	02:24
5a	Communication between the control and live rooms, setting up recording levels	03:14
5b	Setting up a compressor, recording and exporting from the selected software	05:11

Table 2.2 Videos produced for the digital artifact of DAT-228

2.4 Publishing and integration in the Learning Management System (LMS)

Literature on flipped learning mentions the positive effects of realistic representations of learning material in the digital domain (Bassett, 2021; Cochrane, 2005). From the comments that the control group gave in their survey, it seemed that some students felt overwhelmed when they encountered the variety of equipment and settings in the sound studio. Therefore, exposing the students to the studio facilities and equipment in advance of them working physically there was an important design decision. In the literature review, Fisher (2021) explored the use of VR in audio education, however, due to induced sickness he recommended viewing in conventional 2D in the early stages of learning. Therefore, the author settled on designing an artifact for laptop and mobile device use which would enable the students to look around the studio facilities through 360-degree images. Loveys and Riggs (2019) stated that interactivity can play an important role for increasing engagement. In the DAT-228 artifact, the learning material would be accessed through clickable interactive buttons that were placed over devices and areas in the studio that the content related to, as recommended by Voss (2022). The authoring tool that was used for the design of the artifact was Adobe Captivate, due to licensing rights with UiA. Figures 2.4 and 2.5 show images from the live and control rooms with interactive buttons that were overlayed.

Figure 2.4 Screenshot from the live room in the digital artifact

Figure 2.5 Screenshot from the control room in the digital artifact

The conceptual model from figure 2.2 dictated how the instructional content would be sequenced inside the digital artifact. Progress through the learning material was split into three parts: the first regarded setting up a microphone in the live room (included video 1), the second regarded setting up relevant hardware and software components in the control room (videos 2-4), and the third regarded recording and exporting procedures (videos 5a and 5b).

At the end of each part, a quiz was embedded to test student knowledge from that part. The quiz for part one had five questions, and the quizzes for parts two and three had ten questions each. Frydenberg (2013) conducted a study on flipped learning which reported positively on the effect of quizzes in student engagement. That study´s quiz counted a small amount towards the students´ final grade. Long (2016) recommends that quizzes should be kept short so to minimise student workload.

Finally, the resource was published from Adobe Captivate in HTML5 format so that it could be viewed on any device. It was then embedded into the audio course room in Canvas, which is the chosen LMS of UiA, as a three-part graded assignment. The integration was enabled through the SCORM feature, which could track student activity and report names and quiz results to the teachers.

2.5 Design limitations

DSRM informs that once steps 4 (demonstration) and 5 (evaluation) have been implemented, ¨researchers can decide whether to iterate back to activity 3 to try to improve the effectiveness of the artifact¨ (Peffers et al., 2007, p. 56). In an ideal scenario, an early prototype of the artifact should have been produced for the purposes of testing, evaluating, and improving the design, using the students as test participants. However, the nature of the research did not permit for iterative design as the artifact was developed during the summer break period where no students were available, and it needed to be launched at the start of the new semester.

In the next chapter, relevant theories are presented which relate to the artifact from a practical and pedagogical perspective in the context of flipped learning.

Chapter 3

Relevant theories

As we read in chapter 1, the audio course students carry out their participation in the introductory laboratory sessions in groups. Learning is thus a social activity where a collective attempts to master the same skills and construct knowledge by making sense of their experience (Driscoll, 2004). Although aspects from behaviourism such as rewards and punishments have been incorporated in the design and use of the artifact, most notably quiz elements, this research study is being approached from the angle of sociocultural theory, as groups of students learn together in the pursuit of common objectives in the sound studio. We will then look into some key terms in information processing theory, as retention of information has been brought up earlier in the thesis. Lastly, theory regarding motivation will provide a backdrop in connection to different perspectives that can be found in a group of students who have similar experiences.

3.1 Sociocultural theory

Vygotsky (1978) put emphasis on the role of social interaction in the process of learning (Tudge & Winterhoff, 1993). In sociocultural theory it is the interaction between at least two people which is key in knowledge formation (Schunk, 2004). Individual thinking is socially conditioned; hence it is social activity which promotes cognitive development (Imsen, 2020, p. 196). In a similar fashion, Wenger (2000) construes learning as the interaction between personal experience and competence which has been defined and contained within communities of practice.

Sociocultural theory regards language as a central tool in the cognitive developmental process (Imsen, 2020; Schunk, 2004). Vygotsky (1978) viewed language as a mediator between a stimulus and a response, and it is *mediation* which functions as the learning apparatus (Schunk, 2004, p. 294). Language has a social form when communicating with other people, and an inner form which relates to thinking (Imsen, 2020). The latter provides knowledge´s building blocks as it defines how one thinks of and processes the outside world, however, language is not the only mediating tool in sociocultural theory. The components of the environment that the individual finds him/herself in can also act as mediators, such as physical objects, text, and images. Wenger (2000, p. 229) mentioned a *repertoire* of communal resources which includes routines, sensibilities, artifacts, stories, and styles. Overall, mediators form language in thinking (Imsen, 2020; Schunk, 2004).

Formal education is for Vygotsky the arena where *scientific concepts* develop. These concepts belong to the various educational subjects and have a specific meaning. Scientific concepts are connected to *everyday concepts,* which are terms that the individual has been relating too through ¨common, practical activity, and immediate social interaction¨ (Scrimsher & Tudge,

2003, p. 297). Everyday concepts precede scientific concepts as the former become the foundation for the latter in the thinking process (Imsen, 2020). An example in the context of this research project would be when a student describes sound as ¨bad¨ (everyday concept). Through interaction with peers and teachers the student learns that that sound is in fact ¨distorted¨ (scientific concept). A distorted sound has a precise definition which is connected to recording settings in hardware or software components (mediators).

3.1.1 Zone of Proximal Development (ZPD)

A mediating person who knows more than the learner plays a central role in the learner´s development, when the two work together in the *zone of proximal development* (ZPD). This is a key concept in sociocultural theory, as learning moves from a social experience to an individual, internalized experience. A person learns first to do a task with others, before is able to do the task alone (Shabani et al., 2010). An unaided learner can only reach a limited level of competence before she or he stagnates due to gaps in knowledge or experience. That is where a mediating person, the *more knowledgeable other* (MKO), intervenes to guide the learner through `unknown territory´ so that the learner can enhance his or her competence and eventually master doing the task alone (Hammond & Gibbons, 2005). That imaginary area between what a learner can do alone, and what a learner can do with assistance is called the zone of proximal development (Vygotsky, 1978). Figure 3.1 illustrates the ZPD.

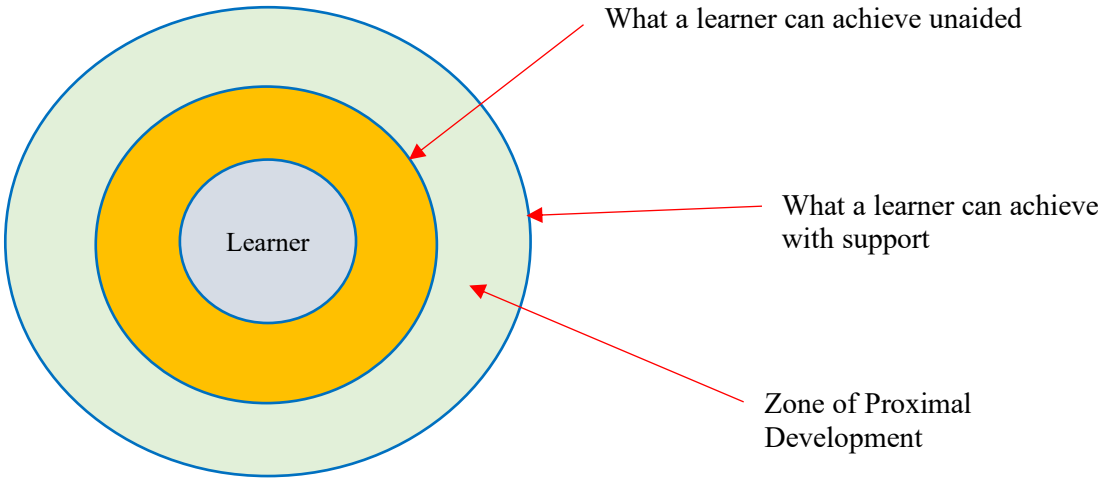

Figure 3.1 Vygotsky´s zone of proximal development

In the ZPD, there are common cultural tools available to both the MKO (teacher/guide) and the learner (Bruning et al., 2010). As the learner interacts with mediators, cognitive development takes place when this interaction is internalized (Schunk, 2004). However, as that internalization inside one´s head is not visible, it is important that the MKO has the correct understanding of, or is given feedback about, knowledge limitations so that the correct assistance can be provided (Imsen, 2020). The ZPD has the effect of providing tailored training for each learner, therefore it should be set up at the right level just beyond – but close to - the learner´s skills (Charlesworth, 1997; Shabani et al., 2010). If the level of assistance lies way outside the boundaries of the ZPD then no learning takes place, as the task is either

too simple or too difficult for the learner (Shabani et al., 2010). Furthermore, the ZPD should be adjusted in tandem with the individual´s continuous cognitive development. Teaching should be ahead of development (Imsen, 2020) so that the learner is constantly challenged.

3.1.2 Scaffolding

Despite not being a term that was used by Vygotsky, scaffolding has being integrally associated with sociocultural theory (Schunk, 2004). Hammonds and Gibbons (2005, p. 8) define scaffolding as ¨task-specific support, designed to help the learner independently to complete the same or similar tasks later in new contexts¨. This support can be successful only when learning activities are set up at a level just above the students´ capabilities, but implementation can be achieved through the provision of scaffolding (Mercer, 1994). During this process, the MKO finishes sections of tasks on behalf of the learners so they can focus on the learning section they strive to master (Schunk, 2004).

3.1.3 Sociocultural theory and self-regulation

The ZPD has also implications for self-regulation. According to Schunk (2005, p. 85), ¨ self-regulated learning is seen as a mechanism to help explain achievement differences among students and as a means to improve achievement¨. Henderson and Cunningham (1994) state that engagement in the ZPD creates a behavioural transformation for the learner, from being externally regulated to practicing self-regulation. Memory, planning, synthesis, and evaluation become higher mental functions as learners reflect consciously on their abilities and efforts. Students who believe that poor performance is a result of poor competence display low motivational levels, whereas confidence in own efforts is linked to efficacious self-regulation (Schunk, 2004).

The next section connects social learning to the need for learners to pay attention to each other and to the environment they find themselves in, that they grasp details and respond to stimulation. It is implicit that during this process acquired information `sits´ somewhere before it is eventually internalized. Thus, the next section investigates the brain´s memory mechanism in the context of information processing theory.

3.2 Information Processing Theory

Information processing is an umbrella term of various theories which deal with the order and execution of cognitive events (Schunk, 2004). Mayer (1996) states that the human mind can be thought of as an information-processing system, which analyses tasks in information-processing stages in the pursuit of knowledge. From a constructivist perspective of information-processing, the learner ¨actively selects, organizes, and integrates incoming experience with existing knowledge¨ (Mayer, 1996, p. 156).

3.2.1 *Information processing model*

Humans receive information through their senses, and filter what is relevant further for mental processing and storing. No learning can exist if information cannot be `attached´ somewhere in the brain, therefore learning and memory are closely related (Imsen, 2020; Sharp et al., 2019).

In the general information-processing model, as proposed for example by Atkinson and Shiffrin (1968), information that is captured in the sensory register is rapidly being forwarded to the working memory. There it is worked on for a few seconds and subsequently it is either integrated with previous knowledge that has been retrieved from long-term memory or it is discarded altogether. Human memory works by either recalling or recognising information. Figure 3.2 illustrates the so-called dual-memory model in information processing.

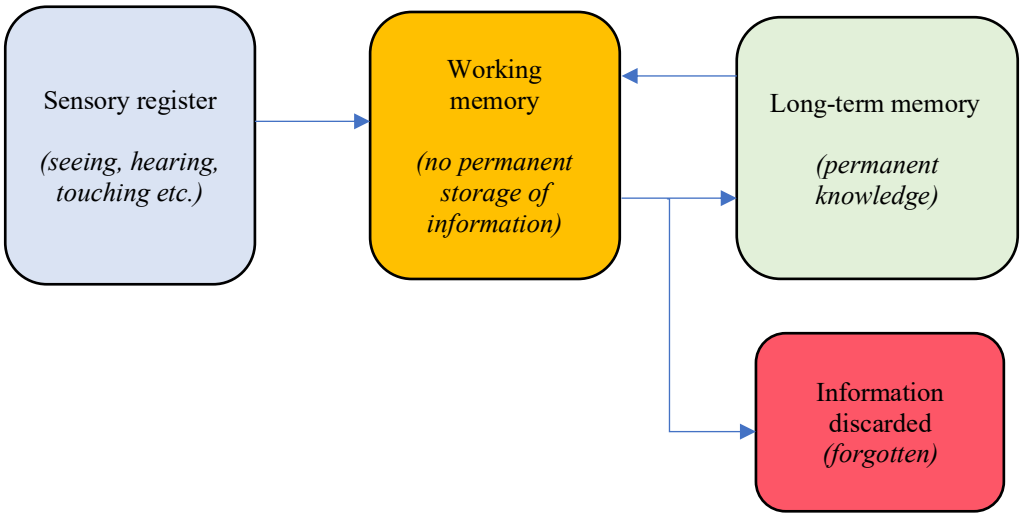

Figure 3.2 Information-processing model

3.2.2 *Working memory*

Working or short-term memory relates to a person´s awareness and is able to store information for a mere 15 to 30 seconds (Imsen, 2020; Schunk, 2004). This section of the human information-processing system deals with tasks such as comprehension and reasoning (Baddeley, 1999). While information is in working-memory, the brain attempts to integrate it with related knowledge that is stored permanently in the long-term memory. *Rehearsal* can maintain information in working memory through repetition to self either aloud or subvocal and can enhance recall (Baddeley, 2010). The more often an idea is being thought of, the better it gets anchored in memory (Schunk, 2004). Miller (1956) claimed that the working memory can keep track of seven plus or minus two items, with words, letters, numbers or definitions being regarded as one item. A meaningful merge of information can increase that limited amount of information that can be stored (Schunk, 2004). Temporal constraints in working-memory have thus clear implications for teaching, not least in verbal dissemination.

3.2.3 Long-term memory

Long-term memory has a large capacity. It bunches together information based on topics (Schunk, 2004), which can also be cross-referenced if it relates to several topic areas (Calfee, 1981). Tulving (1983) divided long-term memory into *procedural* and *cognitive.* Procedural memory contains automatic skills that are learned through practice and do not require a great deal of attention. Cognitive memory is divided into *episodic* and *semantic*. The former relates explicitly to one´s experiences in place and time which is ¨personal and autobiographical¨ (Schunk, 2004, p. 158) , while the latter relates to nonpersonal general, abstract knowledge. It has been postulated that episodic memory precedes semantic, in the sense that one must first go through a personal experience before reaching deeper meaning and knowledge.

3.2.4 Encoding

The conversion of information from the sensory register into permanent knowledge in long-term memory is called *encoding* (Schunk, 2004). *Organisation* and *elaboration* are elements which impact encoding and strengthen memory. The former arranges and categorises information in segments, while the latter connects new information with previous knowledge. When content is organised, it enhances recall of information due to the proximity of related topics. Recalling one topic can lead to the recalling of neighbouring topics. Incorporating audiovisual material in instruction is a recommended organisational approach for enhancing memory (Imsen, 2020; Schunk, 2004) and creates *alternative network paths,* which is additional cognitive routes to access stored information (Anderson, 2020). When human or environmental cues are available during encoding, they can assist in activating knowledge stored in long-term memory (Schunk, 2004) and make a person aware of it .

3.2.5 Attention and forgetfulness

Each sense has essentially its own register, and information that reaches the sensory register only stays there for a fraction of a second (Schunk, 2004, p. 151). Some information proceeds further to the working memory while other is ignored. Attention plays an important role in filtering information and therefore is an essential element of learning. The limited capacity of working-memory is thought to be linked with attentional issues (Imsen, 2020), and it is widely believed that *retroactive interference* is the main reason for forgetting (Craig, 2022; Wixted, 2004). Retroactive interference relates to new information being received just after something has been learned. Based on this, one can easily assume that a large influx of information in a short period of time can lead to cognitive overload and forgetfulness (Imsen, 2020), as the brain struggles to attend to everything that is being `fed´ with. Besides, it can take time to identify relevant information that is stored in long-term memory and relate to it in due time. On the other hand, *decay* results in loss of information if significant time elapses without maintaining or accessing it.

For Imsen (2020) it goes without saying that attention is linked to motivation. People are more willing to focus on something if it is of some significance to them, and attention fosters

collaboration in a social context and creates a sense of purpose. In the next section we will address motivation as a key force behind people´s actions.

3.3 Intrinsic motivation and self-determination theory

Analysing motivation is an examination ¨into the *why* of behaviour¨ (Deci & Ryan, 1985, p. 3). Motivation is closely associated with learning (Schunk, 2004) and is the process which sets in motion and maintains behaviour towards a goal (Pintrich & Schunk, 2002). Motivated students pay attention to instruction, ask questions, make use of information and connect it to previous knowledge (Schunk, 2004).

Self-determination theory (SDT) (Deci & Ryan, 1985) argues that ¨human beings have fundamental psychological needs to be competent, autonomous, and related to others¨ (Deci & Ryan, 2012, p. 85). Fulfilment of these basic needs supports behaviour with volition, whereas suppression of the needs leads to behaviour that is driven by external pressure or loss of motive. Motivation is not a single entity and individuals can experience different types of motivation with different intensity (Ryan & Deci, 2000a). SDT analyses human behaviour in the context of *intrinsic* and *extrinsic* motivation.

3.3.1 Intrinsic motivation

When an individual performs an activity ¨for its inherent satisfactions rather for some separable consequence¨ (Ryan & Deci, 2000a, p. 56), then it is said that the individual is intrinsically motivated. Engagement in the activity is fun and interesting in itself and does not derive from external pressure and/or rewards. ¨Intrinsic motivation is based in people´s needs to be competent and self-determining¨ (Deci & Ryan, 1985, p. 58), while they are surmounting optimal challenges, which can be thought of as ¨incongruities between one´s internal structures and aspects of the external world¨ (Deci & Ryan, 1985, p. 33). In an educational setting, an intrinsically motivated student can learn out of interest and curiosity for the sake of learning, instead of being forced to do, for example by teachers or family (Ryan & Deci, 2000a). Intrinsic motivation has been associated with better-quality learning and educational achievement, as evident in a meta-analysis of several studies by Taylor et al. (2014). Froiland and Worrell (2016) linked intrinsic motivation to student behavioural engagement such as paying attention during class, being vocal in discussions, and perseverance on learning tasks. In addition, Benware and Deci (1984) argued in their study with college students that intrinsic motivation promotes learning retention. Intrinsic motivation has also been associated with higher levels of perceived competence, which can provide ¨useful measures, particularly when used in conjunction with other measures¨ (Deci & Ryan, 1985, p. 35)

3.3.2 Interest

According to Izard (1977), interest is a fundamental emotion behind behaviour that is intrinsically motivated. For Deci and Ryan, ¨interest is, to a large extent, a function of optimal challenge¨ (1985, p. 34). Hidi and Renninger (2006) presented a four-phase model on the development of learner interest based on empirical literature, which distinguishes interest into situational and individual. Situational interest relates to the possibility that certain content, activities or events will activate a response in the moment which may endure over time. Individual interest concerns a deep and ongoing connection that a person has to specific content. In its initial phase, interest is *triggered situational*. In this phase, interest can be sparked by ¨features such as surprising information¨ (Hidi & Renninger, 2006, p. 114), and a learner needs support from the learning environment and others in order to engage (Renninger & Su, 2012). In triggered situational interest a learner may experience either positive or negative feelings. In the second phase, interest is *maintained situational*. Here a learner reengages with the content which triggered attention and receives support from others in making connections with skills, knowledge, and prior experience. Meaningful tasks and personal participation contribute to the preservation of this type of interest, and a learner experiences positive feelings. In the third phase, interest is *emerging individual*. Here a learner is vocal and focused with questions, has stored knowledge, and has positive feelings. Finally, the fourth phase is *well-developed individual*. By that point, a learner is persistent in dealing with frustration and challenges in order to meet goals, while still having positive feelings. However, learner interest can also move in a dwindling direction if support from the learning environment is perceived to be missing (Renninger & Su, 2012).

3.3.3 Extrinsic motivation

¨Behaviours that are executed because they are instrumental to some separable sequence¨ (Ryan & Deci, 2000a, p. 65) define extrinsic motivation. A person who does not perform an activity ¨for the sake of it¨, and instead does it for rewards is extrinsically motivated. Examples of rewards are financial gain, career opportunities, prizes, awards, or acceptance from others (Deci & Ryan, 1985). The avoidance of punishment is also a form of reward as the individual seeks to escape experiencing the negative aspects of punishment such as disapproval, loss of status, or removal of privileges. In an educational environment, extrinsic motivation normally derives from grades and the approval of teachers. Extrinsic motivation is being controlled by outside forces and studies have shown that it has a negative impact on student intrinsic motivation regarding learning (Deci et al., 2001). According to SDT, extrinsic motivation is not a singular entity, in fact it has various forms and certain types of extrinsic motivation can have a positive impact on intrinsic motivation (Ryan & Deci, 2000a). For example, if verbal rewards (i.e., positive feedback) are administered in an informational manner it can lead to a sense of competence on the individual and consequently increase his or her intrinsic motivation (Deci, Koestner & Ryan, 2001).

3.3.4 Self-determination theory

SDT looks into ¨ people's inherent growth tendencies and innate psychological needs that are the basis for their self-motivation and personality integration, as well as for the conditions that foster those positive processes¨ (Ryan & Deci, 2000b, p. 68). According to the theory, the needs of humans for autonomy, competence, and relatedness are viewed as fundamental for their growth (Ryan & Deci, 2020). Humans need to feel that they own their activity, that they are proficient in what they do, and that they are related and connected to others. SDT addresses the conditions under which people can either grow or not develop, with the type of motivation that they feel being a key factor. SDT is comprised of three subtheories: *cognitive evaluation theory, organismic integration theory,* and *causality orientations theory.*

3.3.5 Cognitive evaluation theory (CET)

The first subtheory in the SDT looks on how external rewards and restrictions can negatively affect an individual´s intrinsic motivation. People´s autonomy will diminish if they try to avoid punishment, to meet deadlines, if they expect an award, feel watched, take part in competition, as well as being evaluated or imposed a goal (Deci & Ryan, 1985). When external events are the source for initiating action then a person´s motive, or *locus of causality,* can shift from internal to external. This leads to a reduction in interest and joy for the activity. An internal locus of causality signifies one´s own interests and aspirations as the source for taking action. However, the locus of causality can also shift from external to internal. Several studies mentioned by Deci & Ryan (1985, pp. 59-60) showed that when for example positive feedback is provided informationally to an individual while she or he has a perception of choice in the task, then the locus of causality can shift from external to internal, as the individual feels both autonomous and competent.

3.3.6 Organismic integration theory (OIT)

The second subtheory examines the different types of extrinsic motivation, and the aspects that either foster or hamper that individuals embrace associated values and make them their own (Ryan & Deci, 2000b). According to SDT, this process is called *internalization* and *integration.* OIT presents types of motivation in a continuum from amotivation (lack of motivation) to intrinsic motivation, as shown in figure 3.3.

The theory illustrates those types of extrinsic motivation which can lead to internalization and integration. People who accept actions as important to them experience *identified regulation,* and if they find them compatible with their values and needs, then they experience *integrated regulation.* On the contrary, actions that are done due to external commands are *externally regulated,* and those that relate to the protection of self-esteem relate to *introjected regulation.* According to OIT, internalization is more probable to occur if relatedness is supported (Ryan & Deci, 2000b, p. 73).

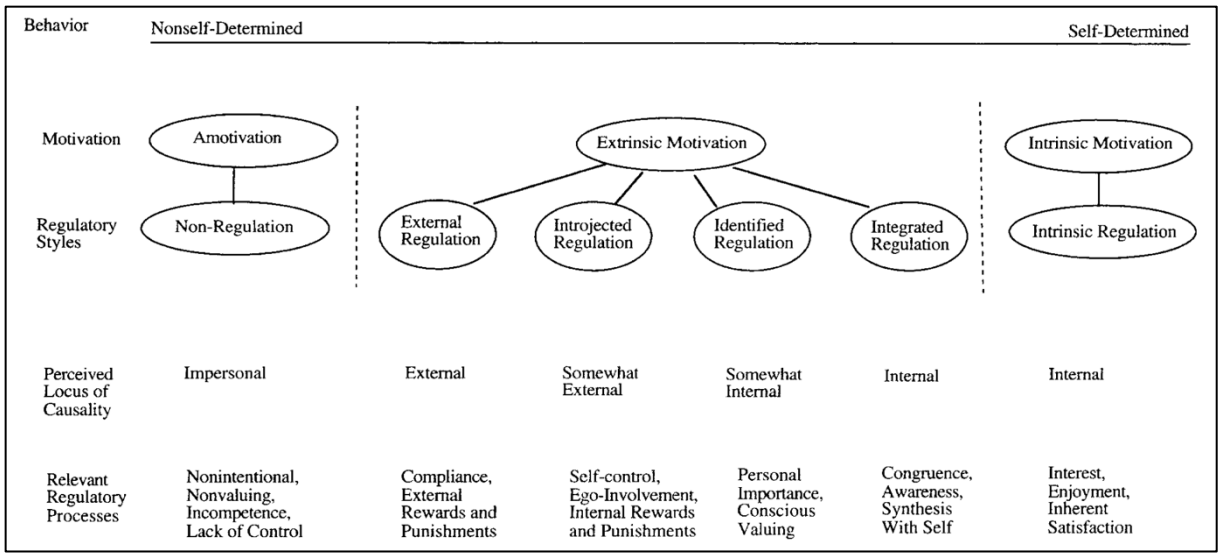

Figure 3.3 Taxonomy of motivation according to OIT, taken from Ryan and Deci (2000b)

3.3.7 Causality Orientations Theory (COT)

The third subtheory states that a person´s particular attitude is a key factor in how he or she responds to stimuli. Deci and Ryan (1985) mention that organisms (people) understand stimuli according to their personality and needs and respond to them correspondingly. Events can be perceived as either informational, controlling or amotivational. For example, let us imagine that a teacher gave the same type of feedback to three different students. The first student perceives it as suggestive (informational), the second as an order (controlling), and the third as overwhelming (amotivational). Each student would then respond differently according to their own perceptions of the event. COT (Deci & Ryan, 1985, p. 151) explains this sequence as O-S-O-R, as illustrated in Figure 3.4.

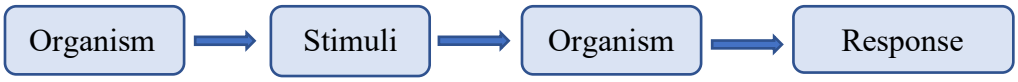

Figure 3.4 Sequence of response to stimuli according to Causality Orientations Theory

Informational, controlling, and impersonal (amotivating) orientations are described as *causality orientations* in the subtheory. COT states that all three orientations exist in different degrees within people, however, one´s tendency dictates how he or she regulates behaviour and what kind of motivation is associated with that behaviour. The autonomy orientation is related to intrinsic motivation as well as the types of extrinsic motivation that can be internalized and integrated. The control orientation is related to extrinsic motivation, and the impersonal orientation to amotivation.

3.4 Summary of some key points from relevant theory

This chapter presented relevant theories that relate to the digital artifact which was developed for the purpose of learning in an audio laboratory environment. Learning activities for the sound studio are socially bound and are seen in this research project within sociocultural

theory. Learning progresses when students are optimally challenged and receive support through scaffolding in the zone of proximal development, by someone who know more than them. Vygotsky´s theory emphasizes the importance of human and nonhuman mediating tools in the learning process.

A key introduction in this research project was the design of a digital mediator for the experimental group students. Face-to-face verbal instruction moved to instruction through pre-recorded videos. Information processing theory states how temporal limitations in the working memory present challenges associated with learning retention. Cognitive overload can be reduced by merging and presenting information in an organised manner. In addition, human and environmental cues can activate previously attained knowledge and link it to current actions. Attention is an important aspect of learning which can be negatively affected through large amounts of incoming information over a short period and result in forgetfulness. Creating space in the flow of information is important, however, too large of a space can result in decay if information is not maintained. Skills that can be performed automatically are stored in long-term memory and put less pressure in working memory.

Lastly, Deci and Ryan state in SDT the human fundamental needs for competence, autonomy, and relatedness. Intrinsic motivation is associated with the satisfaction of those needs, and it is connected to deeper learning, engagement, achievement, and retention of information. Interest is a key emotion behind intrinsically motivated behaviour, and it can be developed in either positive or negative directions. In general terms, external motivation can lead to the suppression of the basic human needs, according to SDT. When external events are responsible for initiating action, they can have a negative impact on intrinsic motivation. Examples are punishments, deadlines, awards, surveillance, judgement, and goal imposition. However, the differing personalities and needs of people play an important role in how each person interprets and responds to stimuli. Learners have a dominant tendency to perceive information either as suggestive, controlling, or overwhelming.

The next chapter presents step 4 of the DSRM, which concerns the demonstration of the artifact (Peffers et al., 2007), and the methods employed for gathering data in connection to the hypothesis and research questions in this study.

Chapter 4

Methodology

This chapter details the tools and techniques used for gathering data in connection with the hypothesis and research questions in this study. As the first research question is of statistical nature, it would require the use of an instrument which could provide concrete measurements of user experience following interaction with the sound studio. The second research question would require methods for analysing the feelings of the participants. From an experimental and educational perspective, the most significant environmental part that was manipulated i.e., the independent variable (Burns, 2000), was the replacement of traditional teaching and instruction by digital teaching and instruction through the online artifact. To gain a deeper understanding on whether flipped learning could have an impact on the students´ learning experience in the studio, as well as their perceived competence and satisfaction, the author used mixed research methods which combined quantitative and qualitative approaches.

Data collection was conducted in three stages, as shown in table 4.1. In the first stage, the control group provided mixed data through an online survey. In the second stage, the experimental group provided mixed data through the same survey and group interviews. In the third stage, the experimental group provided only quantitative data. Stage three served the purpose of giving both groups a similar retrospective distance from the end of their respective audio courses.

	Stage 1	Summer 2022	**Stage 2**	**Stage 3**
Semester	Spring 2022		Fall 2022	Spring 2023
Participants	Control Group	Design of artifact	Experimental Group	Experimental Group
Quantitative Methods	Online survey, close-ended questions		Online survey, close-ended questions	Online survey
Qualitative Methods	Open-ended questions in online survey		Observation, group interviews	

Table 4.1 Overview of research design

4.1 Participants

As already established, the research process was based on two independent groups in a non-randomised between-subjects design. Burns (2000) states that randomisation is ideal in experiments, however it can be challenging to implement in educational research as participant are already assigned in classes. Larger participant numbers can increase the possibility of equally diverse groups being produced. In addition, use of different participant groups addresses the issue of practice effects being transferred between tasks in a test-retest approach.

In stage one of the research process, the control group was comprised of 24 audio course students, out of 41 that were enrolled in 2021-22. In stage two, 53 out of 56 enrolled students participated for the experimental group, with 22 students following up in stage three. The author´s goal in recruitment was to create as large a sample size as possible, as larger samples reduce error and increase accuracy (Burns, 2000; Sauro, 2013a). Participation in the study was on a voluntary basis, and consent was obtained from both the thesis supervisors and the students.

4.2 Demonstration of the artifact

In step 4 of the DSRM, the artifact is demonstrated through ¨use in experimentation, simulation, case study, proof, or other appropriate activity¨ (Peffers et al., 2007, p. 55). In this quasi-experiment, the experimental group was divided into 17 groups of students for the introductory laboratory sessions, with a maximum number of four students per group. Students were allowed to enrol into groups of their choice, as long as there was an available slot. The studio sessions took place over a period of eight weeks in the fall semester of 2022, with the first groups participating in August and the last groups in October. The digital artifact was made available to students in the LMS as an individual compulsory assignment, three days prior to a group´s planned session. This was to ensure that each student was given an equal amount of time to interact with the artifact. Successful completion of the three assignments (as the resource was split into three parts) granted access to participate in the group studio practice on the scheduled day. The three knowledge-based quizzes in the artifact were set up with a pass rate of 80%, with three attempts per quiz allowed. Students had the choice to watch again the learning material before retaking a quiz. The assignment, together with participation in the ensuing studio practice, counted a small amount towards the students´ final grade in the audio course.

4.3 Quantitative data

This method relates to objective hard data which measures numbers (Golafshani, 2003), ¨through the use of experimental or survey design procedures¨ (Jackson et al., 2007, p. 22). Quantitative research presents questions which are direct and quantifiable, and it allows for the investigation of attitudes and behaviours (Goertzen, 2017). Trends can be exposed, and anecdotal information can be justified. A survey is a typical instrument that is used to gather quantitative data. Surveys have certain advantages, such as that they provide identical questions to each participant, which increases reliability (Burns, 2000). Furthermore, surveys can allow for anonymity and thus, invite more honest responses from the participants. On the other hand, a certain disadvantage with quantitative data is that it does not uncover the motivation behind answers and observed behaviour (Goertzen, 2017). Inflexibility is an issue when answers cannot be followed-up, and false responses can be given if participants misinterpret the questions (Burns, 2000).

4.3.1 Online survey

The quantitative data collection tool that was used in this study was an online survey which had at its core the ten-item System Usability Scale (SUS) that was developed by Brooke (1996). SUS is a widely accepted self-reporting instrument for evaluating perceived ease of use in a given product or service (Bangor et al., 2008). It provides a general evaluation of usability according to the international standard ISO 9241-11 (Smyk, 2020), where ¨the usability of any tool or system has to be viewed in terms of the context in which it is used, and its appropriateness to that context¨ (Brooke, 1996, p. 189). In that sense, the author regarded the sound studio as a `product or service´ within the context of synchronous and asynchronous learning. Usability is defined by ISO 9241-11 as the ¨extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use¨ (ISO, 2018). As SUS has a wide applicability by enabling participants to evaluate software, hardware, and websites among other things (Sauro, 2013b), its selection as a quantitative measurement tool for the sound studio seemed suitable since students interact there with hardware and software as a part of a holistic system. Results from SUS would provide statistically analysed data in connection to research question 1 and would be used in conjunction with other data and measurements in connection to research question 2.

SUS is comprised of ten close-ended statements, where participants identify with the degree they agree or disagree with each statement on a 5-point Likert scale. Odd-numbered statements are phrased in a positive way, while even-numbered statements are phrased in a negative way. The original version of SUS, shown in appendix B, uses the word `system´ on each statement evaluation. To avoid confusion and potential misinterpretation of the questions, the author replaced the word `system´ with `sound studio´. This was so the students could have a clear reference in place and time, as both study groups interacted with identical equipment and configurations. Another modification that the author implemented was the replacement of the word `cumbersome´ with `awkward´ on item 8, following recommendations by Lewis and Sauro (2009) in regard to suiting non-native English participants.

For years since its launch, there was an assumption that SUS had a unidimensional function in measuring just usability, however, Lewis and Sauro (2009) revealed in their study that two of its items (statements 4 and 10) can also be used to measure perceived learnability. It comes thus as an additional advantage in this master thesis that quantifiable data could provide an indication on how the students felt that they learned in the aftermath of either pedagogical approach. Another interesting aspect with SUS is its scoring system, which produces an overall evaluation rating from 0 (worst) to 100 (best – numbers do not represent percentages), with 68 being accepted as a satisfactory rating (Sauro, 2013a). This threshold could provide a useful angle for answering the second research question and analyse in more detail any notable differences between study participants. SUS aligns with step 5 in the DSRM, which requires related quantifiable measurements. The scoring system for SUS is explained in appendix C.

According to Izard (1977), interest is a key emotion behind intrinsic motivation, while for Deci & Ryan (1985), higher levels of perceived competence point to intrinsic motivation, and can provide useful measures when other measures are taken into account. Based on these statements, the author included survey items to measure general interest in sound and perceived competence in studio sound work, pre- and post-participation in the audio course. In addition, item 1 in SUS was modified by adding the sentence `not just for my course assignments´ at the end of the statement, to provide an indication of the extent one would wish to engage with the sound studio voluntarily, outside of study demands.

The full survey is shown in appendix D. It was designed in Google Forms and was made available to participants through the LMS without means for gathering personal information about them. The survey was administered to the control group during the spring semester of 2022, while the experimental group received its survey in two stages, the main bulk in the fall semester of 2022 and the two `after´ items in the spring of 2023.

4.3.2 Limitations with quantitative approach

According to Sauro (2013a), the negative wording of the even items in SUS can produce mistakes due to participant error in reversing their scoring, by assuming that higher scoring indicates ¨better¨ responses for all statements. The author cannot verify if such cases existed in this study. Another potential limitation could be the language of the survey which was in English. The author informed the students that they could ask for wording clarifications before responding to the survey. It is not possible to establish the students´ linguistic level in English and whether this has influenced their scoring to any extent.

4.4 Qualitative data

The goal of qualitative research is ¨to capture what people say and do as a product of how they interpret the complexity of their world, to understand events from the viewpoints of the participants¨ (Burns, 2000, p. 11). The primary form of qualitative data is words, which is captured through interviewing techniques with individuals and/or groups (Jackson et al., 2007), as well as comments in a survey (Sharp et al., 2019). Observed behaviour can also produce qualitative data. The qualitative approach affords accessibility to the researcher, and the ability ¨to see (and document) the qualities of social and educational interaction¨ that can be missed by quantitative methods (Burns, 2000, p. 13). An approach which is semi-structured or unstructured, open-ended, and informal can facilitate to uncover themes from both the researcher and the participants (Jackson et al., 2007). On the other hand, qualitative methods come with certain disadvantages, such as large amount of unsorted data as well as potential bias from both sides. The author employed qualitative methods in order to gain insight into the feelings of the students and to look into the motivational aspects behind their behaviour.

4.4.1 Open-ended questions

Following-up closed-ended questions with open-ended questions, is an approach to gain an insight into the participants´ feelings and to provide context (Steele, 2019). This qualitative method allows subjects to provide answers on survey items by using their own words. Neuert et al. (2021) advise that this approach should be used sparingly as it can be cognitively demanding for the respondents, and increase the work of the researcher due to manual coding for extracting themes.

As it was mentioned in chapter 2, the control group provided feedback through comments in open-ended items in their survey. These items related to the five negatively phrased items in SUS (even statements). Responses in these items gave supporting information in regard to defining the problem that the artifact would seek to address and acted as a guide for its design between research stages 1 and 2.

4.4.2 Semi-structured group interviews

In similarity to open-ended questions, semi-structured interviews can provide deeper understanding and context for people´s feelings and behaviour. ¨An interview is a verbal interchange¨ (Burns, 2000, p. 423) where the perspective of the interviewee can be provided (Burns, 2000). With this method the researcher can uncover underlying themes and patterns. The participants can use their own language which is comfortable to them, and the dialogue format in semi-structured interviewing encourages feedback by creating a balanced status with the researcher. The main disadvantage with semi-structured interviews can be the participants´ peculiarity in the way they interpret events and reality. In addition, dominant interviewees can overshadow interviewees who are more reserved. Sharp et al. (2019) state that what study users say does not necessarily fit together with what they do, as they might forget details in their description of events or may want to please the interviewer.

The author conducted semi-structured interviews with fourteen laboratory groups from the experimental group after the end of their session once they completed the online survey. Brook advised that ¨the SU scale is generally used after the respondent has had an opportunity to use the system being evaluated, but before any debriefing or discussion takes place¨ (1996, p. 194). Some guiding questions were prepared in advance in order to focus the interviews on the ¨crucial issues of the study¨ (Burns, 2000, p. 424) which revolved around the students´ experience with the studio and the digital artifact. The author sought to maintain a flexible approach in the conversations, and occasionally asked follow-up questions from the students. Robson and McCartan´s (2016) guide was applied, where the author first explained the purpose of the interview, clarified ethical issues, explained participant rights, and obtained permission to conduct audio recordings for transcription purposes. Benign warm-up questions were asked so to establish a pleasant conversational tone and at the end of the interviews, there was a cooling-off time before the participants were thanked for taking part.

4.4.3 Observation

Being able to see behaviour as it unfolds is the greatest advantage with observation, as it doesn´t depend on people giving retrospective or anticipatory accounts of their behaviour (Burns, 2000). Context is important when observing study participants in natural settings, by paying attention on how participants interrelate with each other, with the technology, and their environment (Sharp et al., 2019). Mays and Pope (1995) state that by adopting a ¨participant observer¨ role, researchers can reduce their influence on the environment they study. However, observation can produce behavioural changes on participants, known as the Hawthorne effect, as they can potentially shift their focus from doing the task given, to thinking about the presence of the observer. This can produce varied behaviour, from feelings of anxiety and self-doubt, to overproductivity in order to please the observer.

Given his background in audio and previous experience with the audio laboratory, the author took the role of guide/mentor during the laboratory sessions for the experimental groups. To increase the credibility of observations, each group was briefed in a similar manner as they arrived for their session. Then, the author handed over a sheet with tasks in the studio, and explained to the groups that these were based on learning material that they had encountered in the digital artifact. Lastly, the groups were informed that they would mainly work unaided and that the author would occasionally come into the studio to observe progress, however, he would mostly maintain a passive role. The author would only intervene through scaffolding if progress came to a halt, however, he did not share this detail with the groups. To reduce the potential influence of the Hawthorne effect, the author removed himself from the studio at times while the groups were underway working with their tasks.

4.4.4 Limitations with qualitative approach

In the interviews, the author wished that the students would express themselves in a language they felt comfortable with, therefore they could choose to speak in Norwegian if they felt limited with English. The author´s first language is not Norwegian and some spoken words from students with dialects were difficult to understand during the interviews. This potentially might have influenced the course of the discussion to some degree; however, all interviews were audio recorded for transcription purposes (and files were deleted after transcriptions), allowing the author to revisit the discussions. Another limitation was the limited scope of observation due to consideration for the Hawthorne effect, and it entails that some behaviour was missed by the author. It is possible that some missed behaviour might have been worth discussing about in the interviews. Lastly, open-ended items were removed from the experimental group survey in favour of semi-structured interviews. The advantage of this choice was that respondent burden was reduced (Bradburn, 1978), on the other hand a potential disadvantage is that some students might have felt shy and could not express themselves as honestly as they would have done behind an anonymous survey. Moreover, more vocal and extrovert students might have overshadowed shy students during the interviews, or perhaps fatigue might have played a role in limited conversational engagement from certain participants.

4.5 Validity and reliability

In research, validity relates to ¨the extent to which a concept is accurately measured¨, whereas reliability refers to ¨the accuracy of an instrument¨ (Heale & Twycross, 2015, p. 66). From a quantitative perspective, validity asks the question, `what does a survey measure? ´ (Burns, 2000). This study has used an established usability instrument to measure the concept of perceived usability in a custom sound studio, as opposed to measuring the actual usability of the studio. For Sauro, ¨the perception of usability can matter more than actual usability¨ (Sauro, 2013a, p. 92), as it has psychological repercussions for participants if they have negative feelings towards what they interact with.

Studies mentioned by Sauro (2013a) concluded that SUS performs better than other custom, `home-made´ usability surveys, and this was an important factor in its selection as a quantitative tool in this study. With *content validity,* expert judgement is used for the verification of surveys (Burns, 2000). During the early days of this research project, the author received approval by the thesis supervisors on using SUS in the context of learning in the studio. In addition, the author consulted a professor and researcher at UiA, whose expert field is usability and user experience evaluation, on the applicability of SUS in multi-component systems, rather on isolated products and devices. Therefore, the author believes that SUS, as a standardised and well-established instrument, has been a valid choice as an instrument in this study.

The reliability of SUS for each study group has been tested for internal consistency using Cronbach´s coefficient alpha, once scoring was converted according to Brooke (1996). The calculations were performed in Microsoft Excel following instructions by O´Loughlin (2021). The coefficient alpha for overall SUS from the control group was .772 and for the experimental group was .757. Both results meet the minimum standard of >.70 (Bland & Altman, 1997; Sauro, 2013a), therefore, the author assumes that both SUS surveys were sufficiently accurate. However, one important difference between the two groups was that SUS was administered to the control group after the end of their audio course due to limitations in this research. As some amount of time had elapsed for the control group since the end of its laboratory participation, it might have led to cases of underscoring or overscoring in its survey. For this reason, differences between the two groups should be approached with a certain amount of caution. In any case, as mentioned in 4.1, increasing participant numbers reduces error (Burns, 2000; Sauro, 2013a). Sauro states that ¨normality should only be a concern for smaller sample sizes (n <30)¨ (2013a, p. 90), although even ¨at sample sizes of 20 and 30 there is less departure from normality¨ (2013a, p. 88)

Carefulness should also be applied in generalising findings. *External validity* is the capability of generalising effects on other populations and settings (Burns, 2000; Hoepfl, 1997), and being able to reproduce results under a similar methodology (Golafshani, 2003). It is possible that certain factors might have influenced the results in this study, reducing thus the extent that these can be applied to other populations and settings. The Hawthorne effect has already been cited as a potential culprit. An important difference in experimental conditions between

the two study groups was the presence of different teachers in their respective laboratory sessions. Professional styles and character differences between the two teachers could be a potential source of inducing bias that might have affected the performance and the opinion of the students in either direction, positive or negative. The author was aware of the potential influence that his presence could have had on the student´s performance in the laboratory sessions, therefore he sought to limit observations at the expense of missing some behaviour. Nevertheless, the fact that this study used custom learning material in a custom sound studio makes it difficult to generalise findings to other population given the limited length of the study.

An attempt to replicate findings and generalise them to other audio education settings would also have to take into consideration that this study involved the use of custom digital learning material that was applicable only in the context of that particular audio course in its own custom recording studio solution. Brooke (1996, p. 190) advocates restraint in making usability and experience comparisons between different systems with different users in different environments, as it would be a ¨case of comparing apples and oranges¨. The focus should thus remain in the behavioural trend of students when they learn through digital mediators in a sociocultural environment.

As mentioned in the literature review, the participation of the audio course teacher as an `actor´ in the videos is assumed to be a positive feature, however, it can also be a potential source of bias. For example, student laboratory groups which worked in the studio towards the end of stage 2 in the research process, were more familiar with the course teacher by that time through attendance to his theoretical classroom lectures, than those groups who worked early in the beginning of the experiment. Familiarity to the teacher might have been an influence on performance and opinions about learning in the studio, affecting thus *internal validity,* which asks the question `do the experimental treatments make a difference in the specific experiments under scrutiny, or can they be ascribed to other factors?´(Burns, 2000, p. 357). Furthermore, maturation might have affected internal validity, as the later-date laboratory groups had been exposed more to audio theory than earlier-date groups. In addition, one cannot exclude the assumption that students who completed participation in the lab might have informed following students about learning material in the digital artifact and processes in the studio. Such events might have had an impact on the credibility of the experiment and the study.

To improve internal validity, the author used triangulation, which relates to the scrutiny of an event from at least two different perspectives (Jupp, 2006), ¨in the study of some aspect of human behaviour¨ (Burns, 2000, p. 419). Methods of triangulation include generating data at different times and/or places, as well as utilising different approaches for data gathering (Jupp, 2006). The qualitative approaches that were used in this study as part of mixed methods served this purpose, as they provided insight to the numbers that were generated through the surveys. However, a challenge with different data collection methods is that they produce different types of data which could be incompatible (Sharp et al., 2019). Codifying the answers given in interviews took a considerable amount of time and some information

given was of no use to this study. Nevertheless, employing more than one data collection technique and more than one data analysis perspective can provide understanding, even if validation of triangulation might be hard to achieve (Sharp et al., 2019, p. 264). The internal validity of qualitative data depends on the credibility of the researcher and it can be improved further by involving other researchers in the analytical process (Patton, 1990). All qualitative methods that were employed in this study were performed by one researcher, who also worked alone on extracting themes from them. This is a limitation as interpretations from interview answers might potentially have been exposed to the ¨researcher´s own belief system¨ (Jackson et al., 2007, p. 26). For this reason, it would be difficult to generalise qualitative data provided in this study and it should be read with caution and as supporting information to quantitative data.

Chapter 5

Results

This chapter presents the results from the surveys, relevant extracts from the interviews, as well as remarks from observations. The mathematical calculations in connection to quantitative data were performed using statistical formulas in Microsoft Excel.

5.1 System Usability Scale

This section presents the results from both study groups on each item of the SUS. Results for each item are first shown separate for each group, to give a visual impression of the distribution. Then, a group comparison of the mean is presented, with values for standard deviation (SD) next to group labels. A full breakdown of the results which also includes the calculations for Cronbach´s coefficient alpha is shown in appendix E. The author selected the mean in the analysis of central tendency, as Sauro advises that ¨it is more efficient and less biased¨ when reporting SUS scores, and ¨it is used in statistical calculations such as the standard deviation and t-tests¨ (2013a, p. 24). Burns also recommends to ¨use the mean wherever possible¨, as ¨sampling theory shows that error is less for the mean¨ (2000, pp. 47-48)

5.1.1 Statement 1

I think that I would like to use this sound studio frequently (not just for my course assignments). 1 - strongly disagree, 5 - strongly agree.

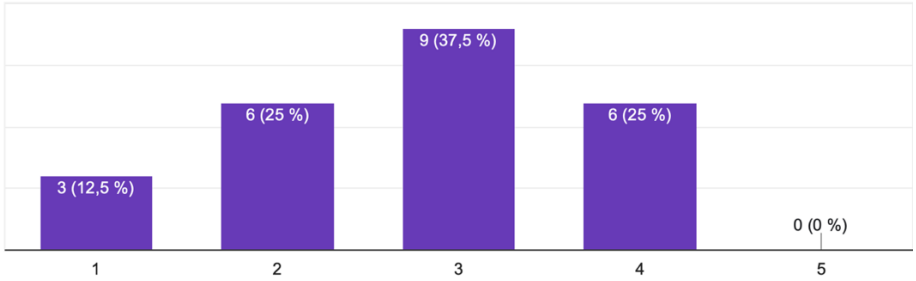

Figure 5.1 SUS item 1, control group (n=24)

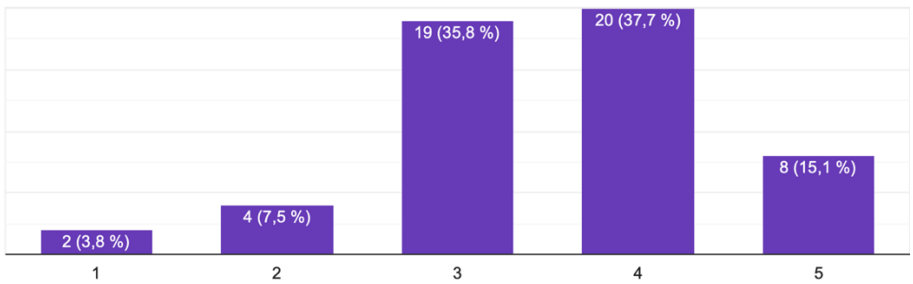

Figure 5.2 SUS item 1, experimental group (n=53)

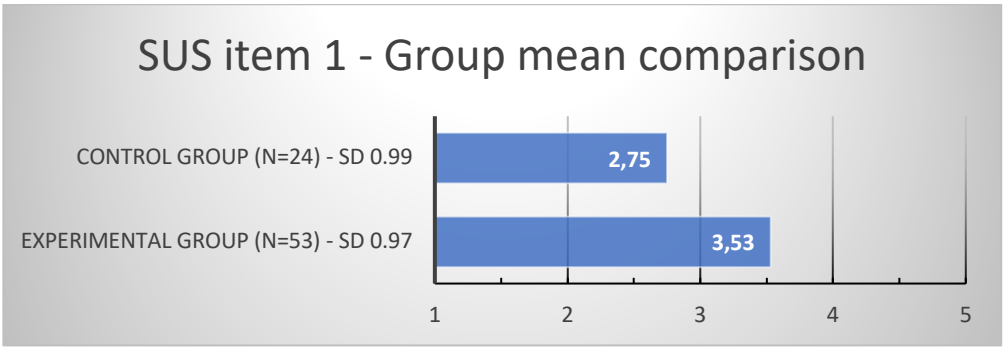

Figure 5.3 SUS item 1, group mean comparison

5.1.2 Statement 2

I found the sound studio unnecessarily complex. 1 - strongly disagree, 5 - strongly agree.

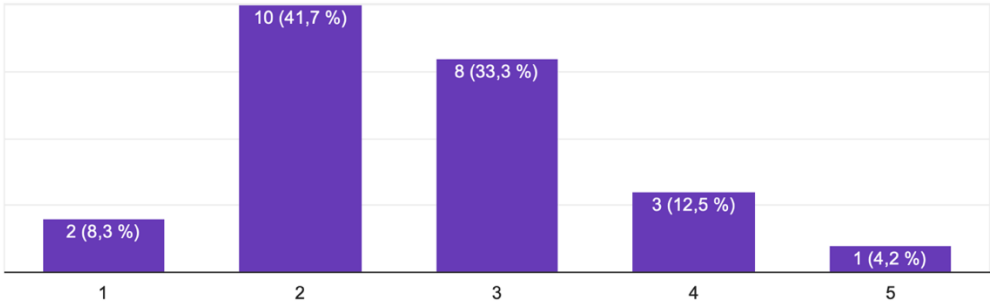

Figure 5.4 SUS item 2, control group (n=24)

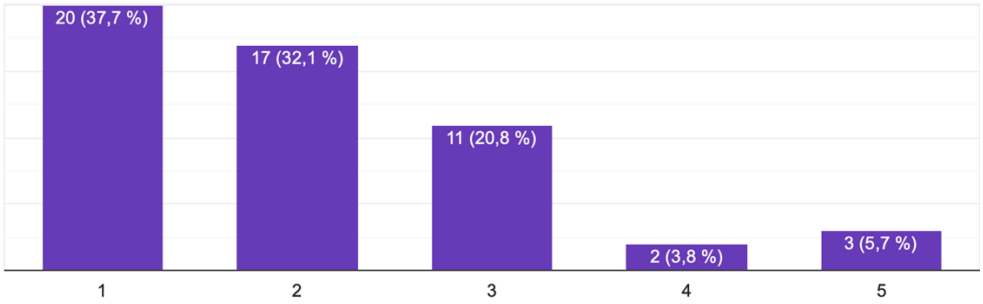

Figure 5.5 SUS item 2, experimental group (n=53)

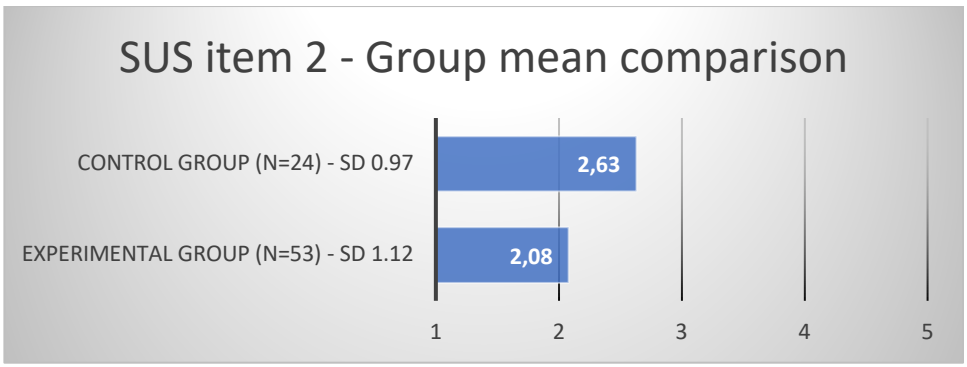

Figure 5.6 SUS item 2, group mean comparison

5.1.3 Statement 3

I thought the sound studio was easy to use. 1 - strongly disagree, 5 - strongly agree.

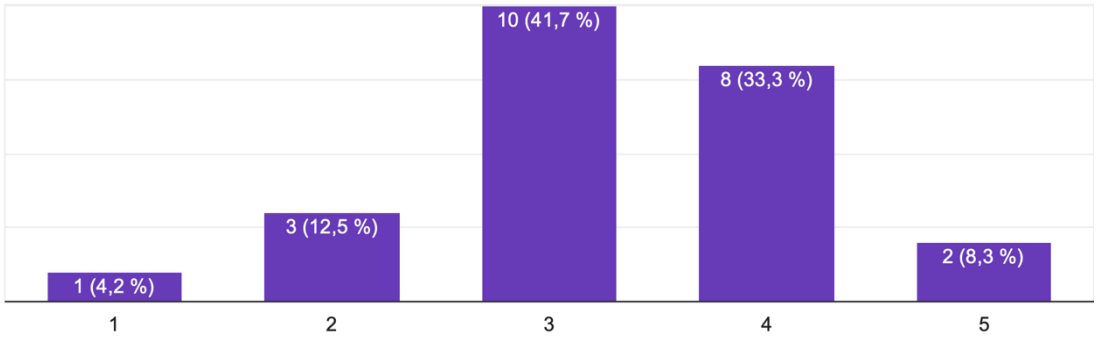

Figure 5.7 SUS item 3, control group (n=24)

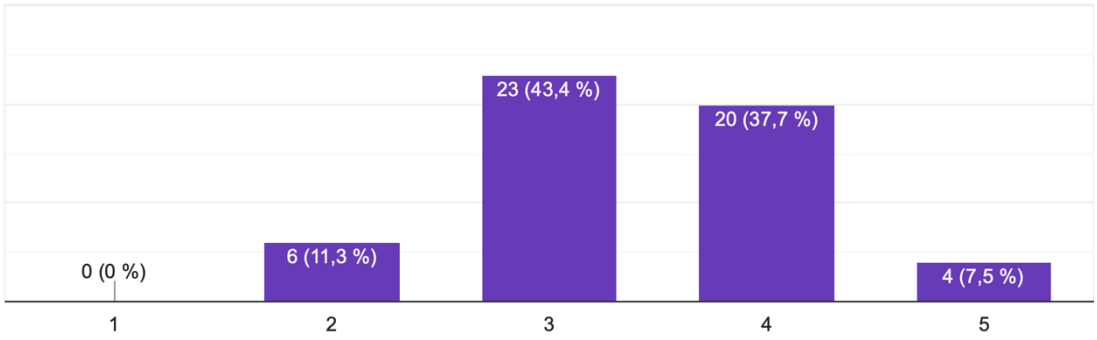

Figure 5.8 SUS item 3, experimental group (n=53)

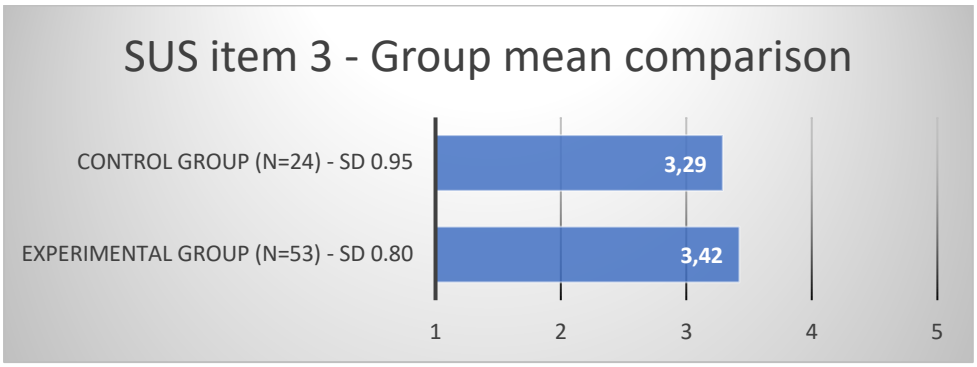

Figure 5.9 SUS item 3, group mean comparison

5.1.4 Statement 4

I think that I would need the support of a technical person to be able to use this sound studio.
1 - strongly disagree, 5 - strongly agree.

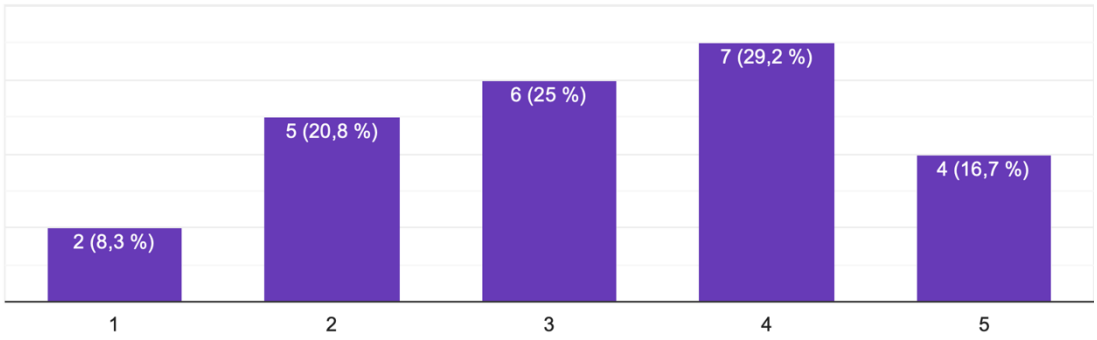

Figure 5.10 SUS item 4, control group (n=24)

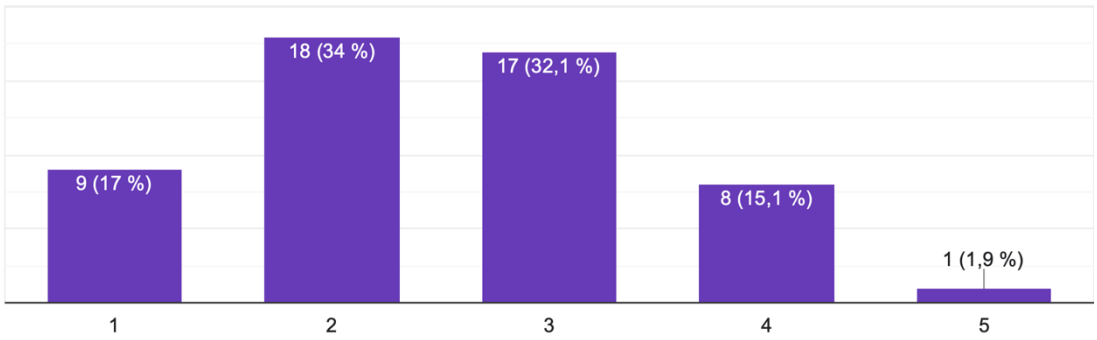

Figure 5.11 SUS item 4, experimental group (n=53)

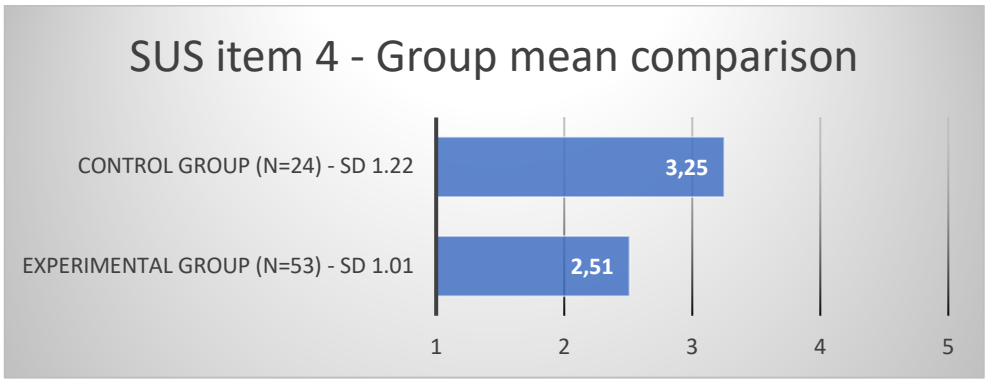

Figure 5.12 SUS item 4, group mean comparison

5.1.5 Statement 5

I found the various functions in this sound studio were well integrated.
1 - strongly disagree, 5 - strongly agree.

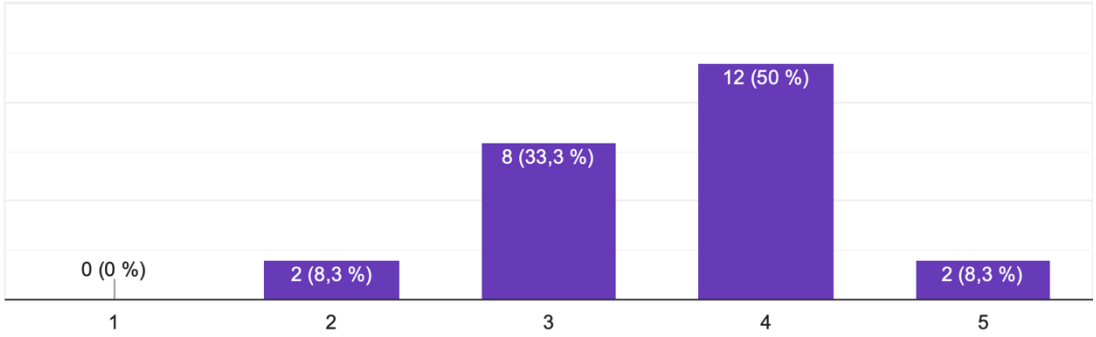

Figure 5.13 SUS item 5, control group (n=24)

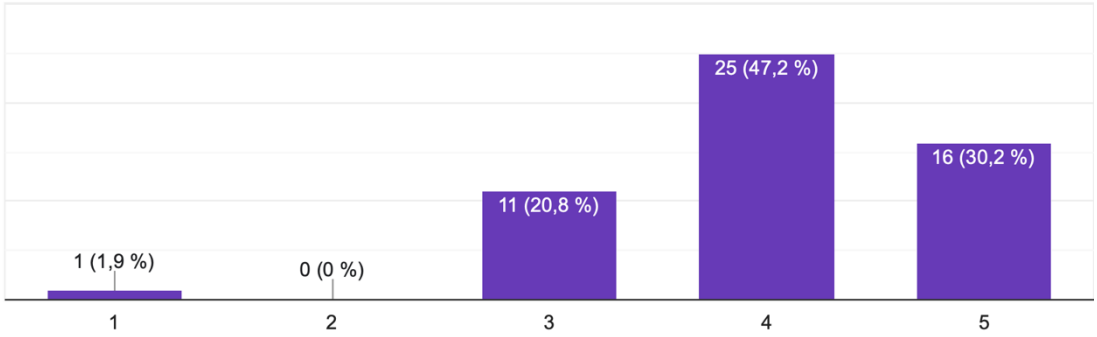

Figure 5.14 SUS item 5, experimental group (n=53)

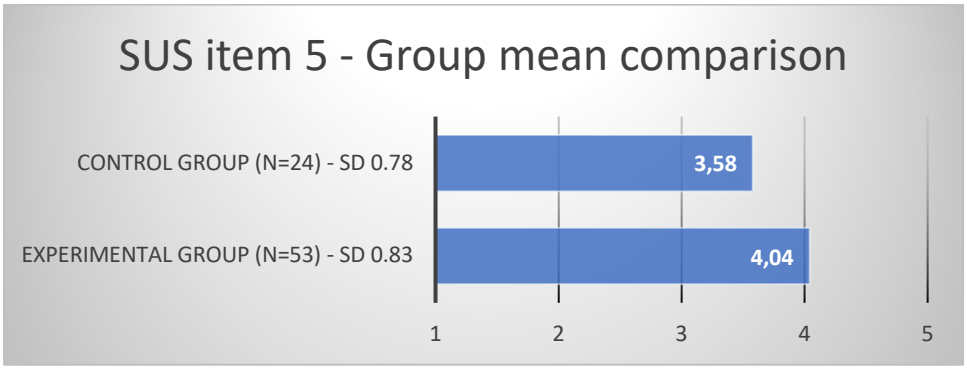

Figure 5.15 SUS item 5, group mean comparison

5.1.6 Statement 6

I thought there was too much inconsistency in this sound studio.
1 - strongly disagree, 5 - strongly agree.

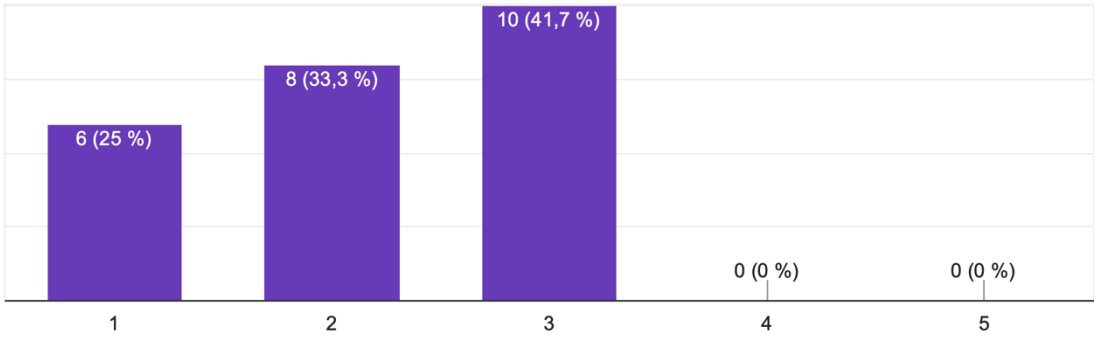

Figure 5.16 SUS item 6, control group (n=24)

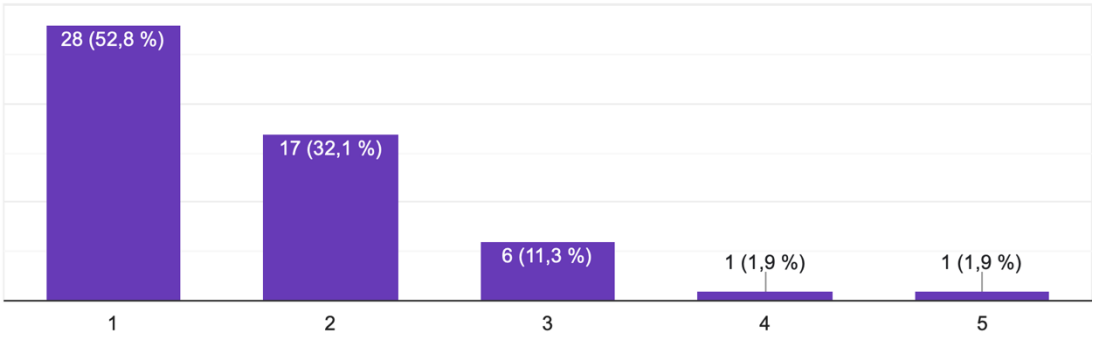

Figure 5.17 SUS item 6, experimental group (n=53)

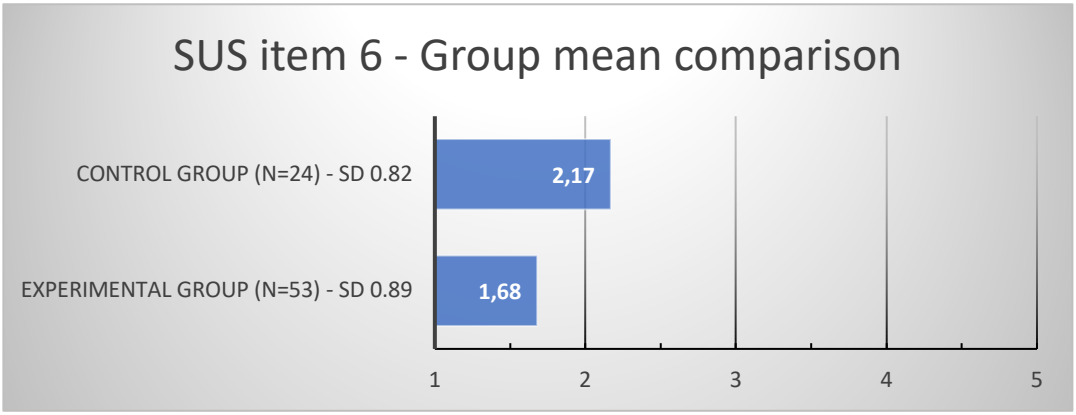

Figure 5.18 SUS item 6, group mean comparison

5.1.7 Statement 7

I would imagine that most people would learn to use this sound studio very quickly.
1 - strongly disagree, 5 - strongly agree.

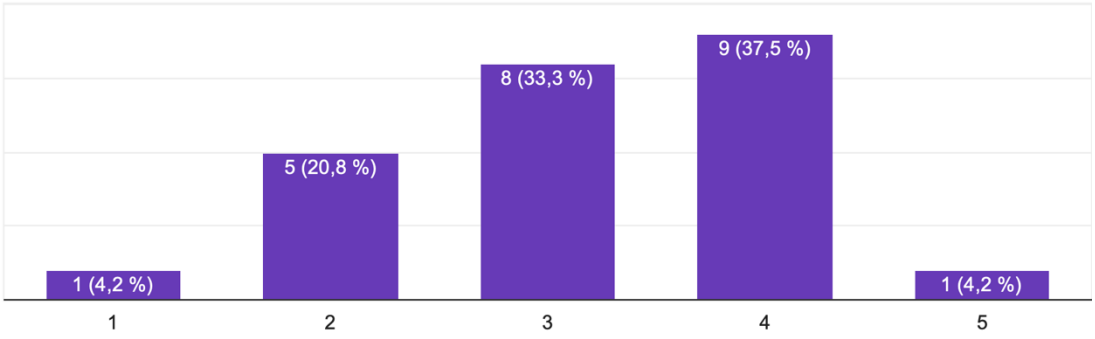

Figure 5.19 SUS item 7, control group (n=24)

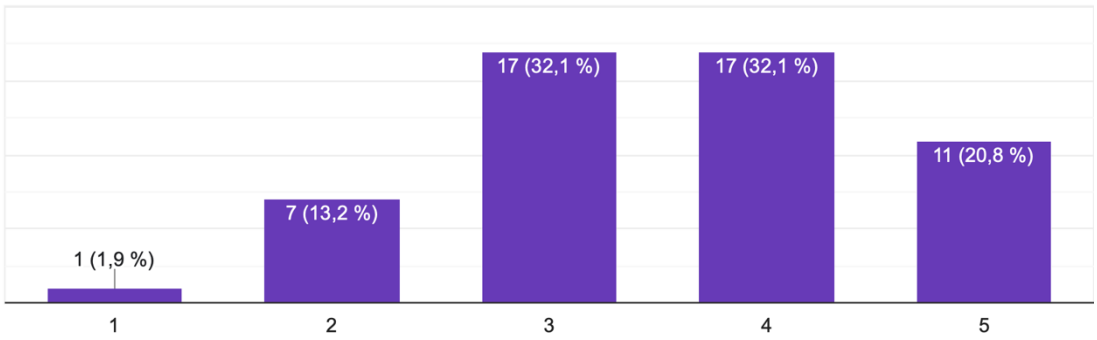

Figure 5.20 SUS item 7, experimental group (n=53)

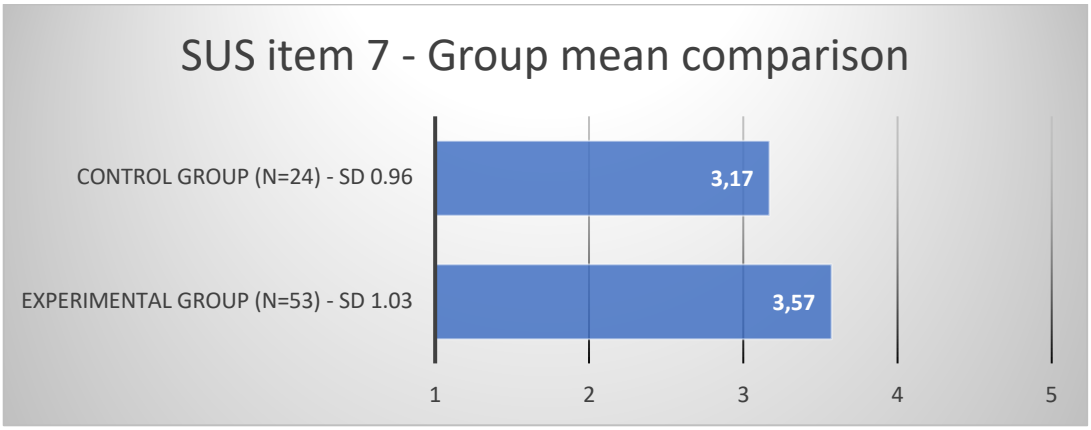

Figure 5.21 SUS item 7, group mean comparison

5.1.8 Statement 8

I found the sound studio very awkward to use. 1 - strongly disagree, 5 - strongly agree.

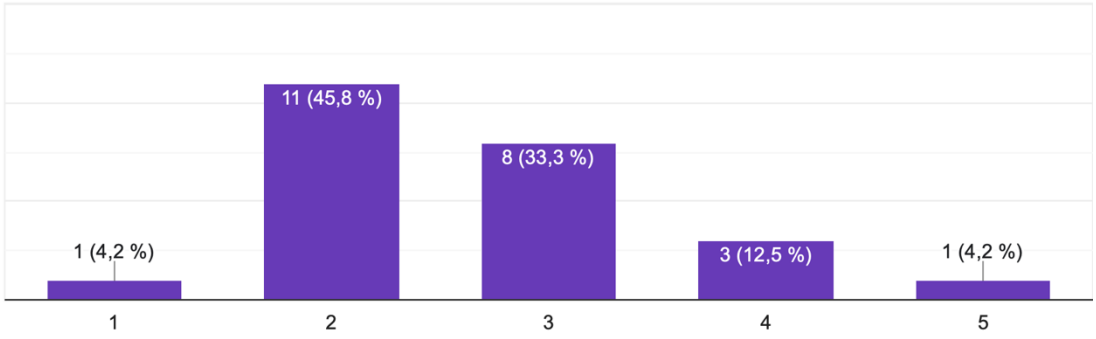

Figure 5.22 SUS item 8, control group (n=24)

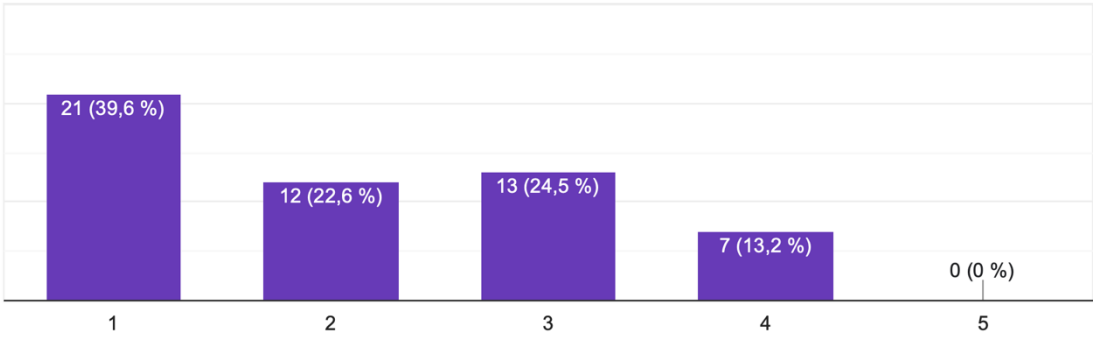

Figure 5.23 SUS item 8, experimental group (n=53)

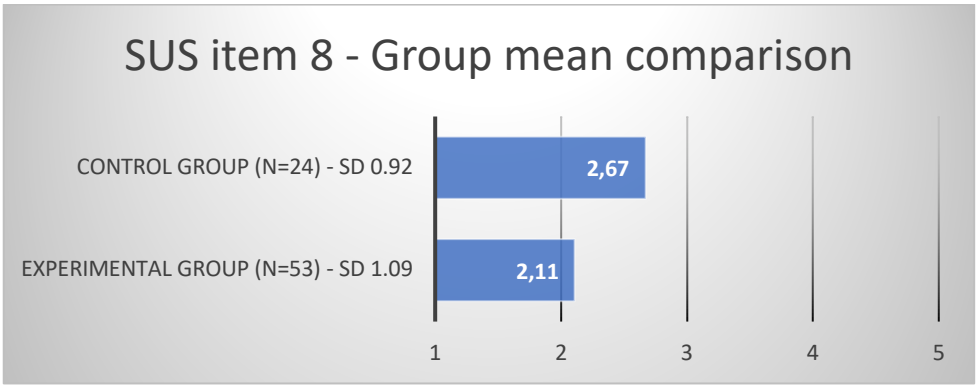

Figure 5.24 SUS item 8, group mean comparison

5.1.9 Statement 9

I felt very confident using the sound studio. 1 - strongly disagree, 5 - strongly agree.

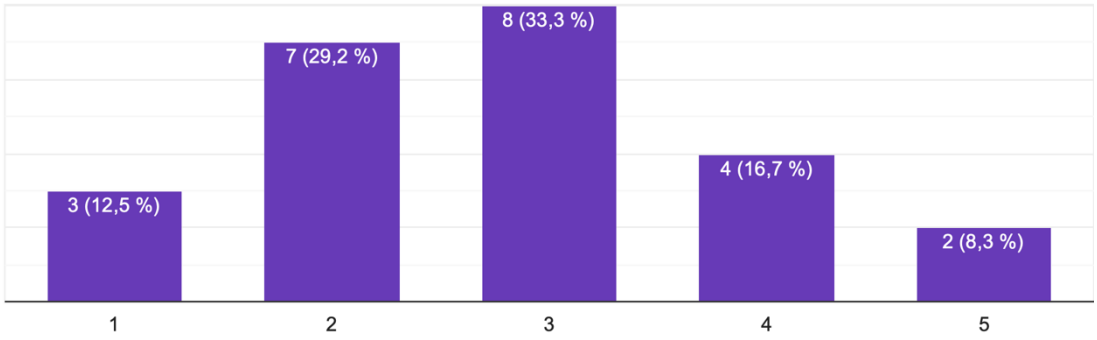

Figure 5.25 SUS item 9, control group (n=24)

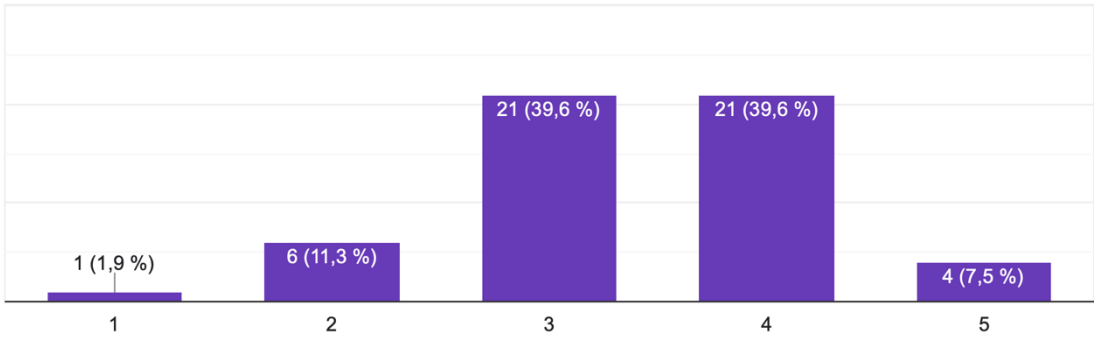

Figure 5.26 SUS item 9, experimental group (n=53)

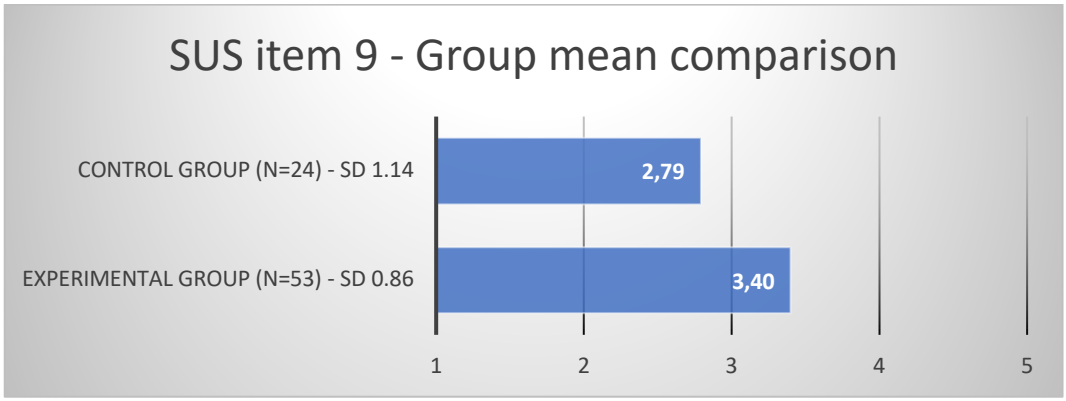

Figure 5.27 SUS item 9, group mean comparison

5.1.10 Statement 10

I needed to learn a lot of things before I could get going with this sound studio.
1 - strongly disagree, 5 - strongly agree.

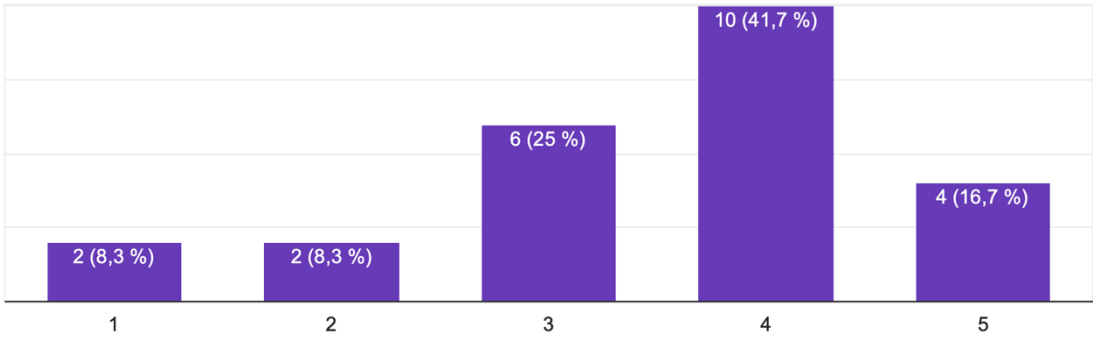

Figure 5.28 SUS item 10, control group (n=24)

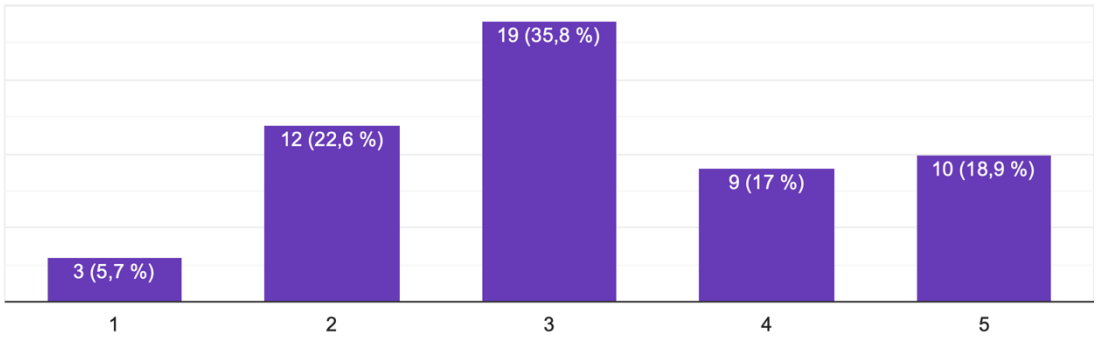

Figure 5.29 SUS item 10, experimental group (n=53)

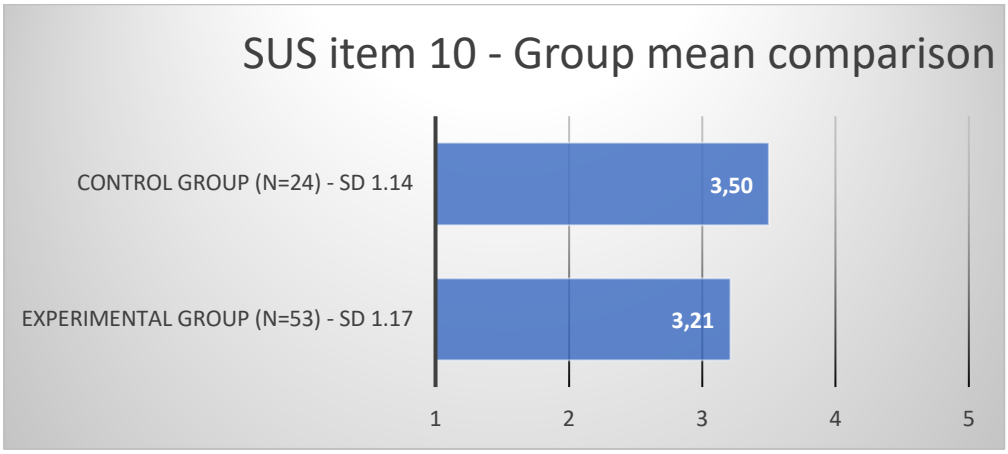

Figure 5.30 SUS item 10, group mean comparison

5.1.11 Overall SUS comparisons

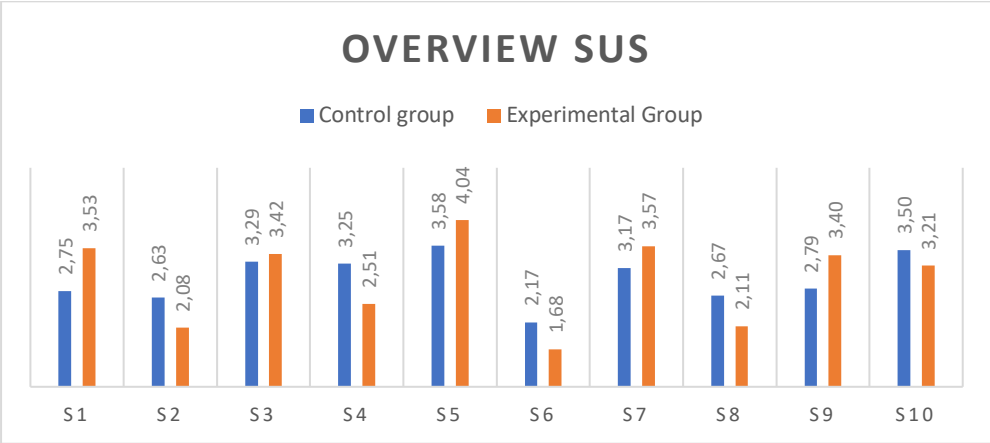

Figure 5.31 Overview of group mean comparison for each SUS statement

As shown in figure 5.31, the experimental group has scored better on all ten SUS items, compared to the control group. Table 5.1 gives an overview of the extent of these mean increases.

SUS	Increase in mean	Increase in percentage
Statement 1	.78	28,36%
Statement 2	-.55	-20,91%
Statement 3	.13	3,95%
Statement 4	-.74	-22,77%
Statement 5	.46	12,85%
Statement 6	-.49	-22,58%
Statement 7	.40	12,62%
Statement 8	-.56	-20,97%
Statement 9	.61	21,86%
Statement 10	-.29	-8,29%

Table 5.1 Overview of mean increase in SUS items in favour of the experimental group

Figure 5.32 shows the comparison only for the two (negatively worded) items relating to learnability, according to Lewis and Sauro (2009).

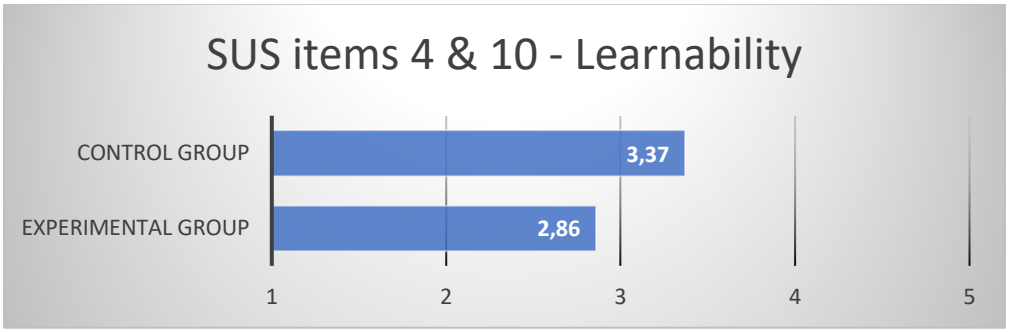

Figure 5.32 Group comparison for SUS learnability items 4 and 10

Figures 5.33 and 5.34 show the aggregate SUS score for each group as well as the split between students who individually scored 68 and above, which is a satisfactory rating (Sauro, 2013a), and those who scored below 68.

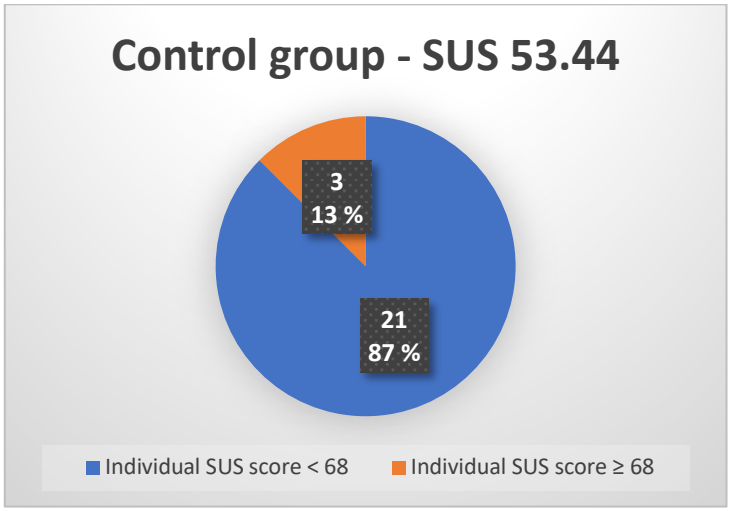

Figure 5.33 Aggregate SUS score for the control group with individual scores divided between ≥ 68 and < 68

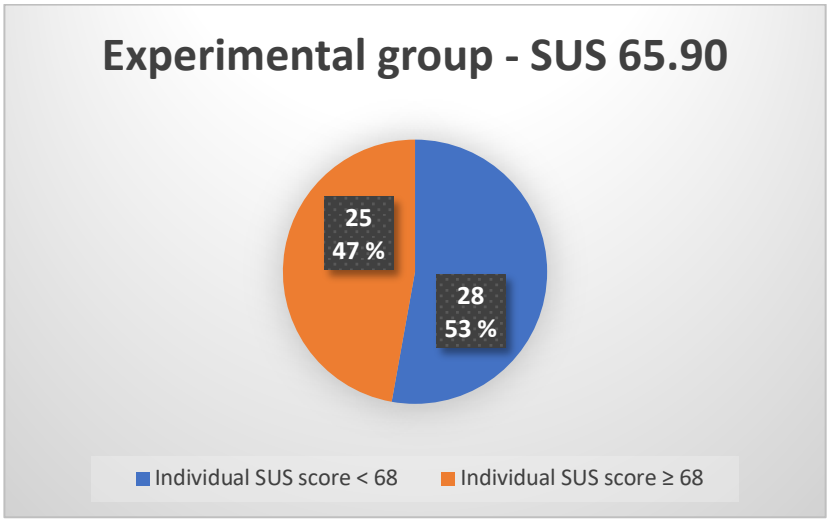

Figure 5.34 Aggregate SUS score for the experimental group with individual scores divided between ≥ 68 and < 68

The observed difference in aggregate SUS scores in favour of the experimental group was statistically analysed using Excel´s t-test formula for two samples assuming unequal variance. The execution in Excel was implemented according to Murray (2020) and it was also verified with Measuring U´s (Sauro) two-tailed calculator. The results, shown in table 5.2, returned a p-value of 0.0004 which is lower than $p < 0.05$, thus rejecting the null hypothesis in connection to research question 1. The p-value from the t-test is also lower at the 0.01 and 0.0005 thresholds for one-tailed tests, giving a strong indication that there is a significant difference in favour of flipped learning students, in terms of their experience as users of the sound studio. Appendix F shows each individual SUS score from the study participants together with the t-test results.

	Experimental group	*Control group*
Mean SUS score	65,89622642	53,4375
Variance	189,9265239	204,2459239
Observations	53	24
df	43	
t-Stat	3,582554994	
P(T<=t) one-tail	0,000430613	
T-Critical, one-tail	1,681070703	

Table 5.2 t-test analysis for SUS for two samples assuming unequal variance

5.2 Interest/perceived competence

This section presents the mean results of the two survey items regarding interest in sound, and perceived competence in studio sound (1-least, 10-most).

5.2.1 Interest in sound

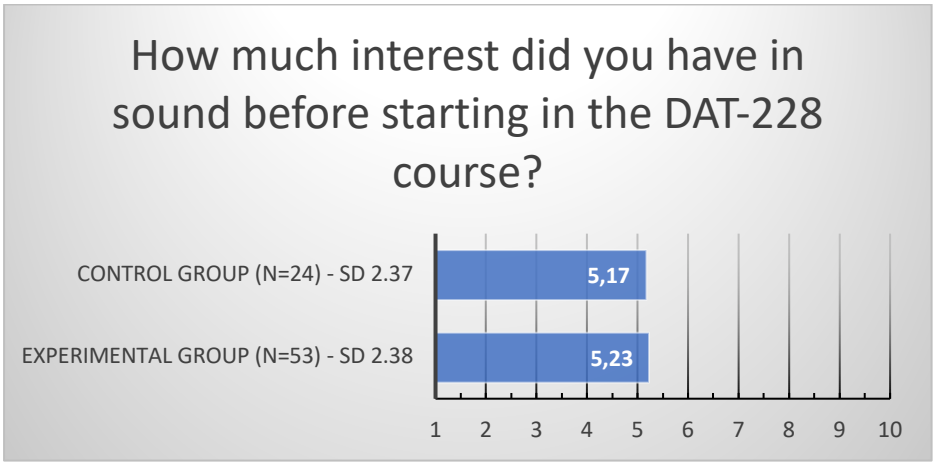

Figure 5.35 Group mean comparison of interest in sound prior participation in DAT-228

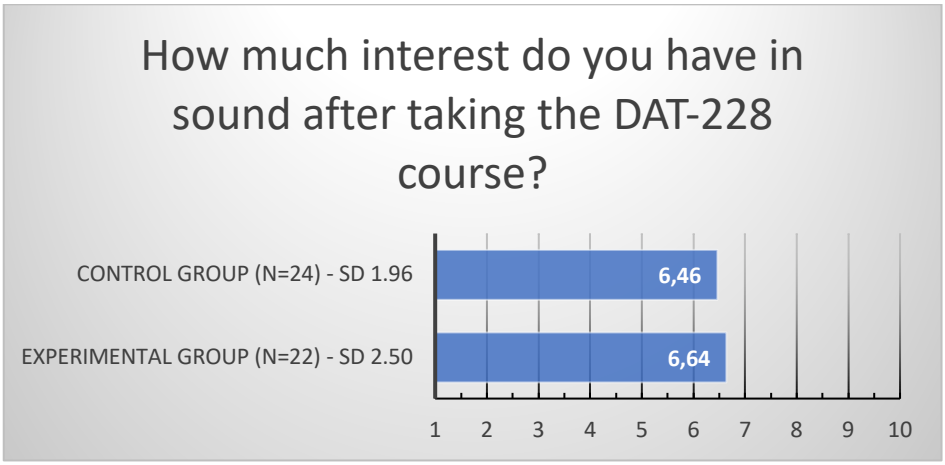

Figure 5.36 Group mean comparison of interest in sound following participation in DAT-228

5.2.2 *Perceived competence*

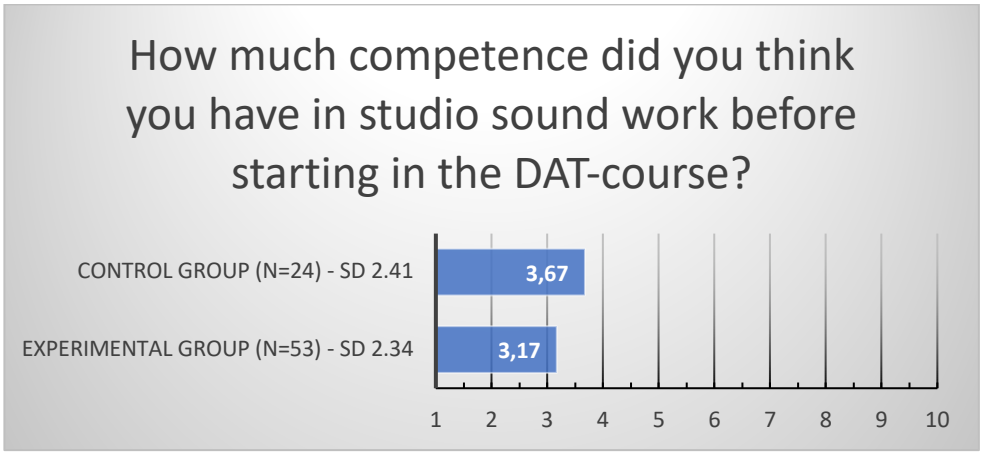

Figure 5.37 Group mean comparison of perceived competence in studio sound prior participation in DAT-228

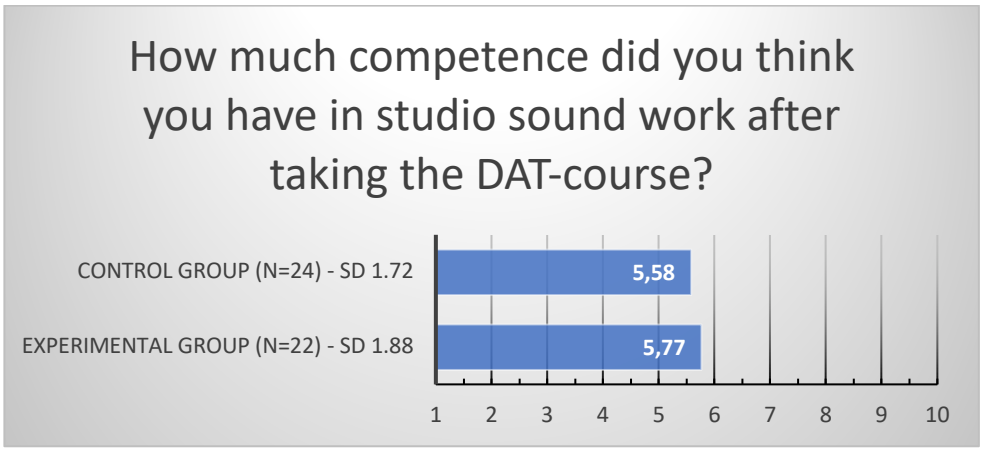

Figure 5.38 Group mean comparison of perceived competence in studio sound following participation in DAT-228

Table 5.3 gives an overview of the mean increases for both groups. Both groups increased their aggregate levels of interest and perceived competence at the end of the audio course. However, the experimental group reported higher gains.

Group	Interest in sound		Increase		Remarks
	Pre-course	Post-course	Mean	Percentage	8,06% higher increase for experimental
Control	5.17	6.46	1.29	24,95%	
Experimental	5.23	6.64	1.41	26,96%	
	Perceived competence in studio sound		Increase		Remarks
	Pre-course	Post-course	Mean	Percentage	57,61% higher increase for experimental
Control	3.67	5.58	1.91	52,04%	
Experimental	3.17	5.77	2.60	82,02%	

Table 5.3 Overview of mean results on interest and perceived competence for both study groups

5.3 Semi-structured interviews

Interviews with fourteen student groups provided insight from their experience with the sound studio and the digital artifact. Full transcripts can be read in appendix G. Some interesting and relevant extracts are presented below.

5.3.1 Opinions on working without and with assistance in the studio

The importance of learning from each other before receiving help from the teacher/guide was brought up in different group discussions. Student 3 from group 2 mentioned, ¨I think it was very nice that we were a group. I was a bit unsure about some things, but we could help each other. We spoke together, we discussed, and we worked it out. It was good as a collaboration, as one learns from this too. One can speak about things he is unsure about, then the other knows or remembers something you have forgotten¨. Student 3 from group 9 mentioned, ¨What I think was best (about the group´s experience in the studio), was that we got a hold of it ourselves. That we did it ourselves. And then you (the teacher/guide) were there so we could ask you and be sure that it worked¨. The students from group 10 stated, ¨It was good that you did not help us that much today. Then we got to explore a bit ourselves and try out. The brain remembers better if one thinks again. When not someone just says ¨press this¨. We had to collaborate properly and that was nice¨.

Several students expressed that the teacher/guide was necessary in the introductory sessions. For example, student 3 from group 6 stated ¨it was nice that you were available so that one could ask about something, and not come to a complete halt because one would not know what to do¨. In group 17, student 1 mentioned ¨I think it helped to have one who knew everything, how you do it, and the bottom line of everything. One who knew if things were correct, why equipment did not work, or if we did something wrong¨. Student 2 added ¨perhaps it would have taken a much longer time if we stood here (in the studio) alone. It was useful that you came here and gave some tips¨. Student 1 from group 2 stated ¨I believe that if we have been here completely alone, we would have whined for a long time. Because it is a lot to remember. But with supervision, I feel that it is fine. It is like throwing children into the water when they cannot swim¨.

On the other hand, some students were confident that they could have worked in the studio only with the assistance of the digital artifact. For example, student 1 from group 13 mentioned ¨I believe we could have managed with these videos we got, and we would have figured it out¨. Student 3 from group 8 had a similar opinion, saying ¨I believe it would have been fine if we watched the videos while working (in the studio) ¨.

5.3.2 Opinions directly related to the digital artifact

The videos received positive feedback from a learning as well as production perspective. Student 1 from group 6 was satisfied with the duration, saying ¨it was good that the videos did not last more than 3-5 minutes, it did not become too much. It was very concrete what we

should do, and this was good´. Student 2 was satisfied with the tempo, commenting ¨I liked the narration in the videos. He (the teacher) speaks very clearly. The speed was good ¨. Student 3 was pleased with the delivery from the teacher in the videos, saying ¨he was good to show which buttons he meant, then one understands what he speaks about ¨. Student 3 from group 5 stated ¨I liked very much that the videos were quite visual, as I can struggle to learn with simple text ¨. Student 2 from group 1 liked that the videos afforded repetition, commenting that ¨it is very good that one can go through the videos several times and see how you do it if you forget ¨. Student 2 from group 11 felt better prepared, saying ¨I liked to have the videos and watch them yesterday. Then I knew a bit what I was coming to, and I was not totally clueless ¨. Similarly, student 2 from group 9 stated that ¨we learned quite a lot by watching these videos before we came. If not, I would have just stood here without understanding anything ¨. In group 4, student 2 began by stating ¨when you went through the videos among other things, then you got a good understanding of how you set up most things in here¨. Then student 1 added, ¨I believe it would have gone a lot slower today if we had not watched them in advance. Now we knew a lot ourselves¨. Student 1 from group 13 mentioned that ¨these learning resources that we received, helped very much to prepare us¨. Student 3 from group 3 mentioned ¨I learned that that button was that which was mentioned in the course, and so I connected what I did in the studio to it¨. The previous examples indicate that many students benefited from being exposed to the artifact a relatively short amount of time before physically working in the studio. As student 3 from group 5 mentioned, ¨I think it was quite ok to take it (the course) just before we went in, while I still had it in memory¨, although student 4 from the same group gave a contrasting answer, ¨but I think it went a bit fast, as I am not so good to learn fast. So, for me it was a bit more difficult that I took it a short time before I went into the studio¨.

Certain design aspects of the artifact received more mixed responses, such as the 360-function. Some students claimed that this feature helped them to prepare and remember better, while for others it caused confusion. For example, student 3 from group 2 stated, ¨with the 3D-viewing, I felt it worked quite well. Because then one knew where things were without having been there (in the studio) before. And then it does not get stressful by beginning to look around ¨. Student 4 added to this by saying ¨if I came here and only had seen 2D images, it would have been like ¨this (what to look for) is circa there¨, while now it was ¨ok, it is in *that* corner ¨. Student 1 from Group 10 described the experience with the 360-function as ¨we got to learn where things were¨, while student 2 said, ¨when I went into the studio, I thought that I had seen things before ¨. Student 3 from group 13 was descriptive, saying ¨it actually helped a bit with knowing where all things were. There hung the cables, there were the microphones, there were the headphones, there one could plug in. It helped to orientate oneself in the room¨. However, on the other side, student 1 of group 1 mentioned ¨I think that with all the question marks and the text boxes, it got a little cluttered for me ¨. Student 2 from group 7 stated ¨it was a complicated way to do it, it would have been easier to simply have a video ¨. Student 1 from group 9 commented that ¨I do not manage to see where I am regarding room orientation. It does not happen before I walk into the room ¨. In general, the 360-function was better accepted for the live room, than the control room.

5.3.3 Technical issues with the artifact

Early in the interviewing process it was revealed that some students experienced technical difficulties as a result of the integration of the artifact in the LMS. For example, student 3 from group 1 mentioned that it ¨did not work that well on my ultrawide screen. I got a thin strip and could not see the top and the bottom, due to stretching¨. Student 3 from group 2 experienced syncing issues with videos after he adjusted the zoom of his screen, saying that ¨I believe the sound played as normal, but the video came after it. I became suddenly confused as the teacher said something, then nothing happened on the screen, then he went on to the next topic and then the previous action was shown ¨. Student 1 from group 4 experienced issues when taking the quiz, mentioning that ¨there were a couple of times when it got stuck in the quiz part. It actually popped out of the quiz ¨. Student 4 from group 6 experienced problems with her mobile device, mentioning ¨it did not work on iPhone. I did not answer the questions there either as I was scared about the quiz (that it would register an unsuccessful attempt) ¨. Student 1 from group 15 also experienced issues with the quiz, commenting that ¨we had issues with the quiz when it was about taking a new attempt. There was an issue with wrong registration of attempts ¨. Student 2 added to this by saying ¨the system thought that I had taken all three attempts ¨. Student 4 of group 3 had issues with watching videos, saying ¨playback was a bit `choppy´, and the videos were a bit small (in the 360-viewing). It was a bit difficult to watch´. He added by saying that `it may have been it takes a bit much (for the system) to process it all and at this was the reason which caused the videos to play slower ¨.

In addition to technical issues, some students had problems with understanding how to use the digital artifact, resulting in user error. For example, student 4 from group 2 said ¨when I took the quiz the first time, I did not know that I could turn (the image) around. I could not read fully one of the questions, so I just guessed. So, I got wrong on the first, as I could not read the question. But I figured it out quickly the second time, it was not that difficult¨. Student 1 from group 11 also experienced challenges in the quiz section, saying ¨first I watched all videos, and then it came up that I should take a quiz, but I did not understand where it was. So, I clicked on something, but nothing happened. But it was my fault¨.

5.3.4 Varied opinions about the studio experience

Overall, it seemed from the interviews that the experimental group had diverse opinions about their experience in the studio, ranging from feelings of enjoyment to feelings of being overpowered. For example, student 1 from group 8 said in a lively tone, ¨it was fun! That I could set up everything from the beginning, even though I did not know so much about the sound studio. That about working with the buttons, it was fun to learn and see how it works¨. On the other hand, student 2 from group 6 had a completely different experience, describing it as ¨hellish. I do not remember everything and then I am stressing a bit¨. In another contrasting example, student 1 from group 10 said that it ¨was a lot of fun. I never believed that I would think sound was so much fun. Now I am thinking that I am looking forward to creating a podcast¨, whereas for student 1 from group 1 ¨it was overwhelming with so many dials and so many switches¨, while student 1 from group 6 said ¨when you come to the studio you become

very unsure straight away. There are a lot of buttons and there is a feeling of it being scary¨. Some students were vocal of being discouraged to engage with valuable equipment, like student 3 from group 17 who said ¨everything is a bit scary; it is overwhelming. A lot of expensive equipment. You are scared of doing something wrong, you almost do not dare to join (in the group work) ¨.

5.4 Observations

As stated in the previous chapter, the author decided to not observe the groups constantly during their laboratory sessions and in addition, he did not take notes while he was seen observing. Hence, data from this qualitative method is limited. However, the author logged some keywords on general trends from the sessions after their completion, such as `group X, patching error during task 1´. The tasks that were given to the groups upon arrival in the studio reflected the sequence of the videos within the digital artifact, as shown in table 2.2. The sessions thus began with rather `mechanical´ studio tasks that concerned rigging processes and finished with higher-level knowledge tasks, such as manually setting up a compressor. It was observed that the tempo of group work was higher in the early, lower-level learning tasks, while it slowed down in regard to more advanced tasks that were related to videos towards the end of the learning material in the artifact. Tasks that were connected to video 5b were mostly in need of scaffolding, in particular the part with setting up a compressor.

An early task was set up in a way to create an optimal challenge for the students through `incongruity´, as stated by Deci and Ryan in the theory chapter. It concerned plugging in the microphone on a different, however identical, preamplifier model than the one that was used in a demonstration on videos 1 and 2. The identical model was using a different physical input from the multitrack studio configuration. Although such alternatives were covered in the learning material inside the artifact, it was observed that some students executed identically what they had seen on the video and initially failed the task.

Chapter 6

Discussion

In this chapter, the results from the mixed methods are analysed in connection to the hypothesis and the two research questions, followed by conclusions and some suggestions for future research. Although Brooke (1996) advocated only the analysis of aggregate SUS scores, the author believes that trends can be revealed through individual item analysis, in addition to aggregate scores. Sauro (2013a) has a more flexible approach on individual item analysis, providing a caution that such approach could have more measurement error.

Research Question 1:
Is there a significant statistical difference at $p < 0.05$ in favour of flipped learning students, in terms of their experience as users of the sound studio?

6.1 Engaging with the sound studio in the context of flipped learning

A central assumption in this study has been that flipped learning would lead to a better overall user/student experience in the sound studio, regarding the introductory laboratory sessions for the audio course DAT-228. A well-established quantitative instrument, the system usability scale, was used to measure the experience of two participant groups. The results showed that the experimental group scored better than the control group on all ten SUS items, and that the statistical analysis of the difference showed that it was significant at the 0.05 threshold (as well as 0.01 and 0.0005 thresholds), to reject the null hypothesis in connection to research question 1. Therefore, the author takes the position that there are strong indications that flipped learning can improve student experience in an audio laboratory, analysing this position as follows.

6.1.1 Flipped learning in the studio within sociocultural theory

Social interaction is a key element in sociocultural theory, with language being a principal mediating tool. The digital mediator created more space for the students to communicate between them, by reducing drastically the time that they listen passively to a teacher/instructor in the studio. As student 3 from group 2 mentioned in section 5.3.1, ¨we spoke together (as a group), we discussed, and we worked it out¨. Such a sentence could be read in connection with the results on statement 4 in SUS (`I think that I would need the support of a technical person to be able to use this sound studio´), as it was the item with the second largest increase in mean, according to table 5.1. The digital artifact made way for more lingual activity in its social form, as the students and the environment supplied cues during group work, activating knowledge that was acquired through engagement with the digital artifact. The combination of the digital and real environments could also have helped in the development of scientific concepts in the vocabulary of the students, as stated by sociocultural theory. As student 3 from group 3 was quoted in section 5.3.2, ¨I learned that

that button was that which was mentioned in the course, and so I connected what I did in the studio to it¨. Receiving scaffolding after the students attempted to complete a task alone, such as the compressor section for example, is assumed to have strengthened cognitive memory according to Tulving (1983). The laboratory groups initially went through a `personal and autobiographical´ experience in place and time while attempting to set up the compressor correctly themselves (episodic memory), then received assistance by the MKO as he participated in completing the section of the task for them while he explained subtle details about the equipment (semantic memory).

6.1.2 The digital artifact and information processing

It can be assumed that a major advantage of learning through the digital artifact outside the studio, was that it gave the students freedom to regulate the flow of incoming information according to their styles and needs. Students could watch videos on their own pace, pause them, and revisit content as many times as they wished within the allocated time. In the digital environment their attention was directed to specific studio areas and processes which demanded attention, instead of receiving excessive visual impressions during traditional teaching. Learning was thus `spread´ in temporal terms, allowing information to settle a bit in the students´ heads before new material arrived. Therefore, it can be thought that cognitive overload in the working memory was reduced, minimising forgetfulness through retroactive interference. The videos were carefully scripted, leaving out any excessive words which were thought that they would not add anything new to the learning segment.

In addition, the digital content was organised into thematic sections, strengthening thus memory during encoding according to information processing theory. Observations confirmed that organisation seemed to have a beneficial effect on memory recall for several students, especially in connection to the `mechanical´ lower-level studio tasks. Several students spoke positively about the realistic representation of the studio through the artifact´s 360- feature, citing for example student 3 from group 2 in section 5.3.2 who said ¨with the 3D-viewing, I felt it worked quite well. Because then one knew where things were without having been there (in the studio) before¨. Consequently, it can be assumed that the experimental group experienced better elaboration through fewer gaps in connecting new with previous information. SUS statements on studio complexity and inconsistency (items 2 and 6 respectively) seem to support these assumptions, as both items had large increases in mean (over 20%) for the experimental group according to table 5.1.

6.1.3 User experience, perceived competence, and motivation

SUS measured the perceived usability of the sound studio, thus, the feelings of the students towards the practical learning facilities. Feeling competent is one of the fundamental psychological needs according to self-determination theory, and supports intrinsic motivation (Deci & Ryan, 1985). Learning cannot exist without memory, therefore, by claiming that the digital artifact provided better support for memory, it is claimed that more students felt competent to a certain degree when they physically met in the studio, as they already had

learned some piece of information. As student 1 from group 17 mentioned, ¨it helped to take the course first, as then I was prepared and did not walk blindly into the studio. It felt that I knew a bit when I came in, as I had seen the 360-resource and answered the quizzes. I think it was effective¨.

The survey results confirmed increases in learnability (Lewis & Sauro, 2009) for the experimental group, as well as higher gains in perceived competence regarding studio sound work (57,61%), shown in table 5.3. These increases could provide an explanation behind the increased number of students (n=25) who reported satisfactory SUS scores (≥ 68), as illustrated in figures 5.33 and 5.34. If higher perceived competence is seen in conjunction with the results from item 3 in SUS (`I thought the sound studio was easy to use´), one could assume that the flipped learning students experienced that higher competence despite having a rather close opinion to the control group on the studio´s ease of use. In other words, the studio did not feel particularly easier to them. Item 3 had the lowest, and marginal mean increase in favour of the experimental group in table 5.1, with 0.13/3,95%. If we refer to the four-phase interest development model by Hidi and Renninger (2006), it could be possible that some students had reached the *well-developed individual* phase by the time they encountered challenges in the studio, and they dealt with them with a positive outlook as they felt that they knew something from before.

Deci and Ryan state, that ¨intrinsic motivation is based in people´s needs to be competent and self-determining¨ (1985, p. 58). It has been established that the experimental group was given more freedom at home and in the studio because of the digital artifact, and it reported higher increases in perceived competence. Hence, the author assumes that a higher number of students experienced higher levels of motivation, whether intrinsic or extrinsic which neared intrinsic, according to the OIT taxonomy (Deci & Ryan, 1985) from section 3.3.6. Item 1 in SUS appears to support this assumption, as it was the item with the highest mean increase in table 5.1, with .78/28,36%. As mentioned in methodology, this item was modified with an added sentence to investigate whether students would be willing to engage with the sound studio voluntarily. According to SDT (Deci & Ryan, 1985), behaviour with volition is supported by the fulfilment of the basic psychological needs.

In summary regarding the first research question, the author believes that there is an indication that user experience, perceived competence, and motivation are interconnected and can be supported better though flipped learning in audio laboratory work. It is assumed that higher levels of motivation played a role in the observed difference in SUS between the two groups, in this particular study and at the specific time of data gathering. However, reduced student participation in the third stage of the survey should be taken into consideration, as well as that the survey items on interest and perceived competence provide supportive data on a surface level. The author recommends that other studies should gather more extensive data during a course semester, including instruments which have specifically been designed to measure motivation.

6.2 Student satisfaction in the laboratory in connection with flipped learning

As a result of its phrasing SUS can be used broadly, however such flexibility comes at the expense of specific measures (Sauro, 2013a). This remark entails that it was not possible to identify specifically which studio processes or components created positive or negative experiences for the students. Perhaps it would have been more useful to administer SUS after each major new process in the studio during a laboratory session, so to get a clear picture on processes which do well and processes which can cause problems. This could be a consideration for a follow-up study, however, in regard to the second research question, the author will refer to the aggregate SUS score as the basis to answer the second research question:

Research Question 2:
To what extent is flipped learning a satisfactory solution for the audio laboratory from a class perspective?

SUS has not been used with the intention to measure the usability of the digital artifact, it has been used in the context of assessing its potential influence on student behaviour and learning in the laboratory. Data in connection to the first research question claimed that the observed difference between the two study groups is statistically significant. Although the aggregate score points to a positive direction, despite the significant increase in favour of the experimental group, its SUS result fell short of 68 points, scoring 65.90 as illustrated in figure 5.34. Data from the interviews revealed that the students have been somewhat divided in their feelings. This split can be visualised in figure 5.34, where for 25 students, their experience of the studio was at least satisfactory (≥ 68), while for 28 students it was below satisfactory (<68). Some factors which could have been responsible for the overall result are discussed below.

6.2.1 Perceptions of support from the digital artifact

Hidi and Renninger´s (2006) model on interest development states that in its first phase (triggered situational interest), learners can experience either positive or negative feelings, as support from the learning environment is needed to engage before developing more advanced types of interest. As the interviews revealed, a number of students had negative experiences from the digital artifact, either due to technical issues or design features which did not inspire, such as the 360-function. Obstacles in the smooth engagement with the artifact might have been a source of some frustration for a number of participants, and potentially distracted them from the task of learning. From the interviews it became apparent that some students were concerned with the technical issue regarding wrong registration of quiz attempts, indicating that it might have induced some feelings of anxiety.

In the second phase of interest development (maintained situational), a learner reengages with previous content and has positive feelings. The author assumes that for the students who developed negative feelings while engaging with the artifact, it was perhaps difficult to

overcome those feelings and reach the second phase of interest. Consequently, these students might have shown up to the laboratory sessions with a negative bias which affected their performance, having thus a reduced interest and joy for the learning activities. As cognitive evaluation theory claims (Deci & Ryan, 1985), a reduction in interest and joy for an activity results in an external locus of causality. This implies that some students participated in group laboratory work because `they had to do it´, and such an assumption points directly to extrinsic motivation. As mentioned in motivation theory, avoiding punishment can be seen as a form of reward which affects motivation negatively. Participation in the laboratory session would eliminate the removal of privileges (not being able to use the studio without having gone through the session), and possible disapproval from peers, however, for a student to feel somehow forced to do something would indicate a type of motivation related to external or introjected regulation according to the taxonomy in OIT (Deci & Ryan, 1985). OIT states that people can experience internalization if relatedness is supported, however, this seems unlikely in this assumption. For those students who experienced compatibility issues with their devices, feeling discriminated is thought to be more probable than feeling related.

From an information processing perspective, participants who experienced disruptions in the flow of learning through the artifact, could have experienced issues with elaboration due to decay. Technical disruptions introduce a longer amount of time between learning interactions, also affecting the rehearsal of information. Such experiences could potentially have led to a reduction in interest and consequently, a reduction in motivational levels. For these reasons, a learning environment which was perceived as unsupportive could have made the students feel that they had less choice and lacked control, which according to OIT´s taxonomy can lead as far as amotivation.

6.2.2 Interest and nonoptimal challenges

According to Deci and Ryan, ¨interest is, to a large extent, a function of optimal challenge¨ (1985, p. 34) and ¨optimally challenging activities maintain or enhance intrinsic motivation¨ (1985, p. 248). Optimal challenges are essential for learning progress in sociocultural theory through scaffolding and Vygotsky´s (1978) zone of proximal development. As stated in the theory section, if the boundaries of the ZPD are set up too high for the learner´s capabilities, then no learning takes place.

As previously mentioned, the ZPD should be adjusted in tandem with an individual´s continuous cognitive development. The author feels that this was rather challenging in a group work setting without continuous supervision, evaluation, and feedback from the students. Humans create knowledge in their heads at different speeds, and as it was stated, a MKO is also dependent on the feedback of the learner so to adjust correctly the ZPD. In this study, the author observed the groups discreetly so to minimize the Hawthorne effect. In addition, he was concerned that the students could have perceived the discreet observation as surveillance, making them thus feel restricted and judged. This could have affected their motivation negatively according to cognitive evaluation theory (Deci & Ryan, 1985). It could be possible that when groups received collective scaffolding in order to progress with studio

tasks, some students found themselves already outside the ZPD, and they did not make particular gains from the assistance that was given at that point. Unfortunately, this could have created feelings of reduced competency and it would have impacted motivation negatively, as claimed by Schunk (2004) in section 3.1.3. This implies that some students might have not transitioned to self-regulation at all, feeling thus constantly externally controlled, as a `goal was imposed´ on them.

6.2.3 One-size-fits-all?

Perhaps one of the most interesting findings from the qualitative data is the different student reactions to the same stimuli, as the examples in the results section revealed. For example, in regard to the 360-feature in the digital artifact, some participants experienced the inclusion of clickable interactive elements as informational, while others experienced it as overwhelming. Considering the technical issues that have been mentioned, some students seemed to perceive them as mild annoyances, while others seemed to perceive them as hugely inconvenient. This draws our attention to causality orientations theory (Deci & Ryan, 1985). Taking COT as a basis, the author assumes that the students responded to stimuli from the digital artifact from different motivational perspectives. The interest of some students might have been triggered by the `surprising information´ (Hidi & Renninger, 2006) that was hidden behind clickable buttons, while for others it might have not given any meaning and it just created extra work for them, thus being a controlling event according to the theory.

Consequently, the author assumes that these personality orientations might have carried on in the sound studio. For some students it might have been interesting and exciting to solve the `puzzles´ of the learning tasks, while for others it might have been overwhelming, and thus amotivating. Although the studio laboratory constitutes only a part of the audio course at UiA, the results regarding the survey item on interest in sound show a small increase for the experimental group. It is not known whether this small increase is directly related to the observed difference in the studio, and future studies could look closer into the evaluation of learning outcomes. Individual SUS scores below 68 points were decreased from 87% for the control group, to 53% for the experimental group (figures 5.33 and 5.34). Although there seems to be a positive direction in favour of a flipped learning solution in this particular study, it seems that there is still a lot of work to be done before generalising its findings. The extent of the technical issues that some students experienced makes it difficult to come up with concrete conclusions in connection to the second research question.

Therefore, it is highly recommended that future studies test digital prototypes rigorously by referring back to step 3 in the DSRM. Error-free artifacts can allow for better evaluation of their pedagogical effectiveness. It is also recommended that more ZPD checking points are implemented in studio laboratory work so that more accurate adjustments can be performed on a group level. However, it is important that an MKO maintains this approach in an informational manner so to support student autonomy.

6.3 Conclusions

This thesis compared the impact of flipped learning, in connection to sound studio laboratory work in an audio course at UiA. Two study groups participated, students who learned through traditional learning, and students who learned through flipped learning by using a digital artifact. The hypothesis claimed that students who participate in flipped learning, have a better user experience in the sound studio, and feel more competent when compared to students who participate in traditional learning. An established quantitative instrument, the system usability scale, was used as the basis for answering two research questions. The results from SUS were analysed together with other data from a mixed methods research approach, and the author´s conclusion was that in this particular study, there are indications which point to better student engagement in the laboratory as a product of flipped learning. However, qualitative data from the students revealed that there is not a simple `yes or no´ conclusion in terms of student satisfaction, due to diverse opinions from the participants and unfortunate technical issues for some when engaging with the digital artifact.

The author recommends that in future studies the users/students are closer involved in the design of flipped educational products, including their involvement in prototype testing. This study has highlighted the importance of returning to the third step in the DSRM, before an artifact is used for educational purposes. In addition, theory on motivation revealed that a digital learning environment needs to be flexible in order to suit better individual personality differences and learning styles. For example, competency could be strengthened through the inclusion of more diverse audiovisual material. Customisation features could provide enhanced autonomy, by letting students choose how they want to learn and memorise best. This study revealed the relevance of customisation regarding realistic and immersive aspects of digital learning artifacts. Lastly, enhanced compatibility and features which would allow for a level of social connection in the early stages of learning could support relatedness. The author believes that these recommendations can provide a good starting point for facilitating for even better individual flipped learning experiences, as they would address interest and intrinsic motivation on a larger scale. Perhaps gamification is a next level flipped learning approach which could provide more diverse, customisable, and social learning experiences in an audio laboratory context and it would be worth investigating.

References

Anderson, J. R. (2020). *Cognitive Psychology and Its Implications* (9 ed.). Worth Publishers.

Atkinson, R. C., & Shiffrin, R. M. (1968). Human Memory: A Proposed System and its Control Processes. *Psychology of Learning and Motivation*, *2*, 89-195. https://doi.org/10.1016/S0079-7421(08)60422-3

Baddeley, A. (2010). Working memory. *Current Biology*, *20*(4), 136-140. https://doi.org/10.1016/j.cub.2009.12.014

Baddeley, A. D. (1999). *Essentials of Human Memory*. Psychology Press.

Bangor, A., Kortum, P. T., & Miller, J. T. (2008). An Empirical Evaluation of the System Usability Scale. *Intl. Journal of Human-Computer Interaction*, *24*(6), 574-594. https://doi.org/10.1080/10447310802205776

Bassett, M. (2021, 22-24 July). *Development of a digital photo-realistic console simulation as a learning/teaching tool.* 2021 AES International Conference on Audio Education, Online. http://www.aes.org/e-lib/browse.cfm?elib=21207

Benware, C. A., & Deci, E. L. (1984). Quality of Learning With an Active Versus Passive Motivational Set. *American Educational Research Journal*, *21*(4), 755-765. https://doi.org/10.3102/00028312021004755

Bland, J. M., & Altman, D. G. (1997). Statistics notes: Cronbach's alpha. *British Medical Journal*, *314*(7080), 572. https://doi.org/10.1136/bmj.314.7080.572

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of Educational Objectives. The Classification of Educational Goals*. Longmans.

Bradburn, N. (1978). Respondent burden. *Health Survey Research Methods*, *79*(3207), 35-40. http://www.asasrms.org/Proceedings/papers/1978_007.pdf

Brooke, J. (1996). SUS: A “quick and dirty” usability scale. In P. W. Jordan, B. Thomas, B. A. Weerdmeester, & I. L. McClelland (Eds.), *Usability Evaluation in Industry* (pp. 189-194). Taylor & Francis.

Bruning, R., Schraw, G., & Norby, M. (2010). *Cognitive Psychology and Instruction* (5 ed.). Pearson.

Burns, R. B. (2000). *Introduction to Research Methods* (4 ed.). Sage.

Calfee, R. (1981). Cognitive Psychology and Educational Practice. *Review of Research in Education*, *9*(1), 3-73. https://doi.org/10.3102/0091732X009001003

Chang, E., Kim, H. T., & Yoo, B. (2020). Virtual Reality Sickness: A Review of Causes and Measurements. *International Journal of Human-Computer Interaction*, *36*(17), 1658-1682. https://doi.org/10.1080/10447318.2020.1778351

Charlesworth, R. (1997). Mathematics in the Developmentally Appropriate Integrated Curriculum. In C. H. Hart, D. C. Burts, & R. Charlesworth (Eds.), *Integrated Curriculum and Developmentally Appropriate Practice. Birth to Age Eight* (pp. 51-73). State University of New York Press.

Cochrane, T. (2005). Interactive QuickTime: Developing and evaluating multimedia learning objects to enhance both face-to-face and distance e-learning environments. *Interdisciplinary Journal of E-Learning and Learning Objects*, *1*(1), 33-54.

Colourbox. Retrieved July 2022 from https://www.colourbox.com/

Craig, M. (2022). Memory and Forgetting. In S. D. Sala (Ed.), *Encyclopedia of Behavioral Neuroscience* (2 ed., pp. 425-431). Adademic Press.

Deci, E. L., Koestner, R., & Ryan, R. M. (2001). Extrinsic Rewards and Intrinsic Motivation in Education: Reconsidered Once Again. *Review of Educational Research*, *71*(1), 1-27. https://doi.org/10.3102/00346543071001001

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic Motivation and Self-Determination in Human Behaviour*. Plenum Press.

Deci, E. L., & Ryan, R. M. (2012). Motivation, personality, and development within embedded social contexts: An overview of self-determination theory. In R. M. Ryan (Ed.), *The Oxford handbook of human motivation* Oxford University Press.

Driscoll, M. P. (2004). *Psychology of learning for instruction* (3 ed.). Pearson.

Eidsheim, N. S. (2009). Desktop Simulation: Towards a New Strategy for Arts Technology Education. *Journal for Learning through the Arts*, *5*(1), 1-21. http://escholarship.org/uc/item/4zx5x60c

Eppard, J., & Rochdi, A. (2017, 10-12 April). *A Framework for Flipped Learning* 13th International Conference Mobile Learning, Budapest, Hungary.

Fisher, S. Z. (2021, 22-24 July). *Signal Flow Training with Virtual Simulations as a Co-Curricular Tool* International Audio Education Conference, Online. http://www.aes.org/e-lib/browse.cfm?elib=21228

Froiland, J. M., & Worrell, F. C. (2016). Intrinsic motivation, learning goals, engagement, and achievement in a diverse high school. *Psychology in the Schools*, *53*(3), 321-336. https://doi.org/10.1002/pits.21901

Frydenberg, M. (2013). Flipping Excel. *Information Systems Education Journal*, *11*(1), 63-73. https://isedj.org/2013-11/N1/ISEDJv11n1p63.html

Goertzen, M. J. (2017). Introduction to quantitative research and data. *Library Technology Reports*, *53*(4), 12-18. https://www.proquest.com/scholarly-journals/introduction-quantitative-research-data/docview/1903876597/se-2

Golafshani, N. (2003). Understanding Reliability and Validity in Qualitative Research. *The Qualitative Report*, *8*(4), 597-607. https://doi.org/10.46743/2160-3715/2003.1870

Guo, P. J., Kim, J., & Rubin, R. (2014, 4-5 March). *How Video Production Affects Student Engagement: An Empirical Study of MOOC Videos* L@S '14: Proceedings of the first ACM conference on Learning @ scale conference, Atlanta, Georgia, USA.

Hammond, J., & Gibbons, P. (2005). Putting scaffolding to work: The contribution of scaffolding in articulating ESL education. *Prospect*, *20*(1), 6-30. https://search.informit.org/doi/10.3316/aeipt.143258

Heale, R., & Twycross, A. (2015). Validity and reliability in quantitative studies. *Evidence-based nursing*, *18*(3), 66-67. https://doi.org/10.1136/eb-2015-102129

Henderson, R. W., & Cunningham, L. (1994). Creating interactive sociocultural environments for self-regulated learning. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulation of Learning and Performance. Issues and Educational Applications* (pp. 255-281). Routledge.

Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design Science in Information Systems Research. *MIS Quarterly*, *28*(1), 75-105. https://doi.org/10.2307/25148625

Hidi, S., & Renninger, K. A. (2006). The Four-Phase Model of Interest Development. *Educational Psychologist*, *41*(2), 111-127. https://doi.org//10.1207/s15326985ep4102_4

Hoepfl, M. C. (1997). Choosing Qualitative Research: A Primer for Technology Education Researchers. *Journal of technology education*, *9*(1), 47. https://doi.org/10.21061/jte.v9i1.a.4

Honeycutt, B. (2016). *Flipping the College Classroom: Practical Advice from Faculty*. Magna.
Imsen, G. (2020). *Elevens verden. Innføring i pedagogisk psykologi* (6 ed.). Universitetsforlaget.
ISO. (2018). *ISO 9241-11:2018(en). Ergonomics of human-system interaction — Part 11: Usability: Definitions and concepts*. International Organization for Standardization. https://www.iso.org/obp/ui/#iso:std:iso:9241:-11:ed-2:v1:en
Izard, C. (1977). *Human Emotions*. Plenum Press.
Jackson, R. L., Drummond, D. K., & Camara, S. (2007). What Is Qualitative Research? *Qualitative Research Reports in Communication*, *8*(1), 21-28. https://doi.org/10.1080/17459430701617879
Jupp, V. (2006). *The SAGE Dictionary of Social Research Methods*. SAGE.
Karanikolas, S., Loveys, B., Riggs, K., McGrice, H., Snelling, C., Winning, T., & Kemp, A. (2016). *The Rise of the Flip: Successfully engaging students in pre-class activities through the use of technology and a flipped classroom design template* Show Me The Learning. Proceedings ASCILITE 2016, Adelaide, Australia. http://2016conference.ascilite.org/wp-content/uploads/ascilite2016_karanicolas_concise.pdf
Kerr, B. (2015, 20-24 September). *The flipped classroom in engineering education: A survey of the research* International Conference on Interactive Collaborative Learning (ICL), Florence, Italy.
Lankford, E. (2021, 22-24 July). *Active Learning in Audio Education: How Classroom Space Affects Pedagogy* AES International Conference on Audio Education, Online. http://www.aes.org/e-lib/browse.cfm?elib=21201
Lewis, J. R., & Sauro, J. (2009, 19-24 July). *The Factor Structure of the System Usability Scale* International conference on human centered design, Berlin, Heidelberg.
Long, T., Logan, J., & Waugh, M. (2016). Students' perceptions of the value of using videos as a pre- class learning experience in the flipped classroom. *Technology Trends*, *60*, 245-252. https://doi.org/10.1007/s11528-016-0045-4
Loveys, B. R., & Riggs, K. M. (2019). Flipping the laboratory: improving student engagement and learning outcomes in second year science courses. *International Journal of Science Education*, *41*(1), 64-79. https://doi.org/https://doi.org/10.1080/09500693.2018.1533663
Lucero, A. (2015, 14-18 Semptember). *Using Affinity Diagrams to Evaluate Interactive Prototypes* INTERACT 2015, Bamberg, Germany. https://link.springer.com/chapter/10.1007/978-3-319-22668-2_19
Martin, D. (2021, 22-24 July). *Introduction to Music Recording: Course Design Details and Discussion* 2021 AES International Conference on Audio Education, Online. http://www.aes.org/e-lib/browse.cfm?elib=21226
Mayer, R. E. (1996). Learners as Information Processors: Legacies and Limitations of Educational Psychology´s Second Metaphor. *Educational Psychologist*, *31*(3), 151-161. https://doi.org/10.1207/s15326985ep3103&4_1
Mays, N., & Pope, C. (1995). Observationalmethodsinhealthcaresettings. *British Medical Journal*, *311*(6998), 182-184. https://doi.org/10.1136/bmj.311.6998.182
Mercer, N. (1994). Neo-Vygotskian theory and classroom education. In B. Steirer & J. Maybin (Eds.), *Language, literacy and learning in educational practice* (pp. 92-110). Multilingual Matters.

Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review*, *63*(2), 81-97. https://doi.org/10.1037/h0043158

Murray, J. (2020). *One-tailed Independent Samples T-Test*. https://www.youtube.com/watch?v=LTmWT6YGICs&list=PLMy16Q8-gy_7c15jXXqSwH2z8_9tahknn&index=10

Neurt, C., Meitinger, K., Behr, D., & Schonlau, M. (2021). Editorial: The Use of Open-ended Questions in Surveys. *Methods, data, analyses : a journal for quantitative methods and survey methodology (mda)*, *15*(1), 3-6. https://nbn-resolving.org/urn:nbn:de:0168-ssoar-73172-3

O´Loughlin, E. (2021). *How To... Calculate Cronbach's Alpha in Excel*. https://www.youtube.com/watch?v=Hgf22LMcOHc&t=312s

Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2 ed.). Sage.

Peffers, K., Tuunanen, T., Rothenberger, M. A., & Chatterjee, S. (2007). A Design Science Research Methodology for Information Systems Research. *Journal of Management Information Systems*, *24*(3), 45-77. https://doi.org/10.2753/MIS0742-1222240302

Pintrich, P. R., & Schunk, D. H. (2002). *Motivation in education: Theory, research, and applications* (2 ed.). Prentice Hall.

Renninger, K. A., & Su, S. (2012). Interest and Its Development. In R. M. Ryan (Ed.), *The Oxford Handbook of Human Motivation* (pp. 167-187). Oxford University Press.

Robson, C., & McCartan, K. (2016). *Real World Research* (4 ed.). Wiley.

Ryan, R. M., & Deci, E. L. (2000a). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology*, *25*, 54-67. https://doi.org/10.1006/ceps.1999.1020

Ryan, R. M., & Deci, E. L. (2000b). Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being. *American Psychologist*, *55*(1), 68-78. https://doi.org/10.1037110003-066X.55.1.68

Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self.determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*, *61*, 1-11. https://doi.org/10.1016/j.cedpsych.2020.101860

Sauro, J. *2 Sample T-Test Calculator*. Measuring U. https://measuringu.com/calculators/2-sample-t-calc/

Sauro, J. (2013a). *A Practical Guide to the System Usability Scale*. CreateSpace Independent Publishing Platform.

Sauro, J. (2013b, 18 June 2013). *10 Things to Know About the System Usability Scale (SUS)*. Measuring U. Retrieved 9 January 2023 from https://measuringu.com/10-things-sus/

Schunk, D. H. (2004). *Learning Theories. An Educational Perspective* (4 ed.). Pearson.

Schunk, D. H. (2005). Self-Regulated Learning: The Educational Legacy of Paul R. Pintrich. *Educational Psychologist*, *40*(2), 85-94. https://doi.org/10.1207/s15326985ep4002_3

Scrimsher, S., & Tudge, J. (2003). The Teaching/Learning Relationship in the First Years of School:Some Revolutionary Implications of Vygotsky's Theory. *Early Education & Development*, *14*(3), 293-312. https://doi.org/10.1207/s15566935eed1403_3

Shabani, K., Khatib, M., & Ebadi, S. (2010). Vygotsky's Zone of Proximal Development: Instructional Implications and Teachers' Professional Development *English Language Teaching* *3*(4), 237-248. https://eric.ed.gov/?id=EJ1081990

Sharp, H., Rogers, Y., & Preece, J. (2019). *Interaction Design. Beyond human-computer interaction* (5 ed.). Wiley.

Smyk, A. (2020, 17 March). *The System Usability Scale & How It's Used in UX*. Adobe. https://xd.adobe.com/ideas/process/user-testing/sus-system-usability-scale-ux/

Snyder, K. P. (2017). Audio and Education. In A. King, E. Himonides, & S. A. Ruthmann (Eds.), *The Routledge Companion to Music, Technology, and Education* (pp. 117-126). Routledge.

Steele, J. (2019, November 15). Closed-ended vs Open-ended questions: Everything you need to know. https://www.linkedin.com/pulse/closed-ended-vs-open-ended-questions-everything-you-need-john-steele/

Taylor, G., Jungert, T., Mageau, G. A., Schattke, K., Dedic, H., Rosenfield, S., & Koestner, R. (2014). A self-determination theory approach to predicting school achievement over time: the unique role of intrinsic motivation. *Contemporary Educational Psychology*, *39*, 342-358. https://doi.org/10.1016/j.cedpsych.2014.08.002

Troya, J., Parejo, J. A., Segura, S., Gámez-Díaz, A., Márquez-Chamorro, A. E., & del-Río-Ortega, A. (2021). Flipping Laboratory Sessions in a Computer Science Course: An Experience Report. *IEEE Transactions On Education*, *64*(2), 139-146. https://doi.org/10.1109/TE.2020.3016593

Tudge, J. R. H., & Winterhoff, P. A. (1993). Vygotsky, Piaget, and Bandura: Perspectives on the Relations between the Social World and Cognitive Development. *Human Development*, *36*(2), 61-81. https://doi.org/10.1159/000277297

Tulving, E. (1983). *Elements of Episodic Memory*. Oxford University Press.

Urgilés, J., Carrión, G., Pinos-Vélez, V., Abril-Ulloa, V., Karina, & Quinde-Herrera. (2019). Experiences in the application of the Flipped Learning model in a Music Technology course. *MASKANA*, *10*(2), 15-20. https://doi.org/10.18537/mskn.10.02.02

Vandemast-Bell, P., Werner, D., & Crossley, J. (2015, 20 August). *Seeking best practice for education and training in the recording studio* AES 26th UK Conference: Audio Education, http://www.aes.org/e-lib/browse.cfm?elib=17868

Voss, B. (2016). Information on demand in the recording studio: Building the case for teaching music technology with an interactive agenda. *Australian Journal of Music Education*, *50*(2), 24-38. https://www.researchgate.net/publication/318119630

Voss, B. (2022). Design principles for music technology education support: Just-in-time learning in the recording studio using mobile technologies. *journal of music, technology & education*, *14*(1), 21-42. https://doi.org/10.1386/jmte_00032_1

Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Wenger, E. (2000). Communities of Practice and Social Learning Systems. *Organization*, *7*(2), 225-246. https://doi.org/10.1177/135050840072002

Wixted, J. T. (2004). The psychology and neuroscience of forgetting. *Annual Review of Psychology*, *55*, 235-269. https://doi.org/10.1146/annurev.psych.55.090902.141555

Appendix A – Responses to open-ended survey items

This appendix presents the control group´s comments on open-ended items in their online survey.

Open question to SUS statement 2 – I found the sound studio unnecessarily complex (optional answer)

N3: The PC-part and to-do things in the right order can be difficult from time to time, and suddenly there can be noise and/or problems with sound recording.
N4: I somewhat know how to operate sound systems.
N6: Tror studioet har det folk trenger og ikke for mye ting.
N7: A lot of equipment that I'm not sure how to use, and don't use it enough to remember everything.
N9: Etter å ha fått veiledning så har det gått veldig greit å bruke lydstudio.
N10: Why are there that many buttons and switches compared to our use cases (only using a studio microphone).
N15: It's a lot to remember when setting up the studio and making it ready for recording.
N18: It's not really that complex, but since I don't really use it that often I don't really know where to find stuff.
N19: Studioet oppleves som nyttig og nok så greit å bruke.
N21: There are some things you need to remember when using the studio, but other than those few steps there really isn't much difficulty in using it.
N23: Følte ikke det var unødvendig komplekst.
N24: It's only complex if you don't know how to use it. But I think it has a lot of good tools that shouldn't get removed.

Open question to SUS Statement 4 - I think that I would need the support of a technical person to be able to use this sound studio (optional answer)

N3: As said in question 2, "Suddenly there can be noise and/or problems with sound recording." These are problems I have had and never understood why. A technical person present would hopefully know the source to the problem.
N4: I somewhat know how to operate sound systems.
N6: Av og til funker ikke ting helt som det skal, vist noe først er feil innstilt får ikke vi til å fikse det selv så må ha hjelp
N9: Det er ikke alt jeg husker fra den ene session med veiledning, så å ha en person lett tilgjengelig eller muligheten å kontakte hvis jeg skulle trenge hjelp.
N10: Sometimes maybe
N18: Again, because I don't use it that often I'm not really sure about where different stuff are, I'm also not that confident in my abilities when it comes to sound.
N19: Har opplevd noen problemer ved bruk.
N20: i answered 5 because my memory is bad so I'd forget certain things.

N21: I think I could manage to turn on and use all the systems in the sound studio without anyone helping me.
N23: Noen ganger trenger jeg support da det er vanskelig å huske alt på grunn av flere mange fag
N24: It took us a couple of sessions in there before we remembered how to turn on and connect stuff, it would be nice with maybe a tutorial poster on the wall.

Open question to SUS Statement 6 - I thought there was too much inconsistency in this sound studio (optional answer)

N3: The sound and the recording has been good quality every time, unless there where these problems I said in the question 2 explanation.
N4: The overall experience is good, I think.
N10: No.
N21: I wouldn't say there is inconsistency. You have all the tools you need, and the programs needed to use them. Knowing how to utilize them is another story.
N24: I think it's consistent.

Open question to SUS Statement 8 - I found the sound studio very awkward to use (optional answer)

N10: It was complicated compared to the use case and I've explained earlier.
N18: See answers earlier.
N19: Med veiledning var studioet greit å bruke, men siden opplæringen var så langt unna når vi selv skulle ta det i bruk var det vanskelig å huske.
N21: I think you can be very efficient in the studio.
N24: Not necessarily awkard, but difficult to use for sure if you don't have experience with sound. A lot of buttons and stuff you can press on.

Open question to SUS Statement 10 - I needed to learn a lot of things before I could get going with this sound studio (optional answer)

N3: I personally have a musical family and background, which helped me understand easier.
N4: You do to some degree need to know how to operate both DAWs as well as physical audio gear to properly utilize the studio.
N10: Well, you need to learn how to turn stuff on and how things work for you to know what to turn on and what to plug in.
N19: Jeg følte mye av det vi gikk gjennom var nytt.
N21: As I said before, only a couple of steps to remember, how to turn on the studio and the different applications.
N23: Mye nytt og lite erfaring med lyd fra før.
N24: We had our teacher giving us a tutorial, but we did not remember everything after the first time.

Appendix B – The System Usability Scale (SUS)

1. I think that I would like to use this system frequently.
2. I found the system unnecessarily complex.
3. I thought the system was easy to use.
4. I think that I would need the support of a technical person to be able to use this system.
5. I found the various functions in this system were well integrated.
6. I thought there was too much inconsistency in this system.
7. I would imagine that most people would learn to use this system very quickly.
8. I found the system very cumbersome to use.
9. I felt very confident using the system.
10. I needed to learn a lot of things before I could get going with this system.

Appendix C – SUS scoring system

Study participants respond to individual statements on a scale of 1 to 5 (strongly disagree to strongly agree). Then each item´s scale is being converted on a range from 0 to 4.

Odd items (1, 3, 5, 7, and 9): Participant score minus 1. For example, if a participant scored 3, then following conversion it becomes 3-1=2.

Even items (2, 4, 6, 8, and 10: 5 minus participant score. For example, if a participant scored 3, then following conversion it becomes 5-3=2.

Then, all ten converted scores per participant are added together and multiplied by 2,5 to convert a scale from 0 to 40 to a SUS scale of 0 to 100.

Appendix D – Online survey

The control group received all survey items shown below. For the experimental group, the open-ended items and item 15 were removed. The remaining items were administered in research stage two (fall 2022), except items 13 and 14 which were administered in stage three (spring 2023).

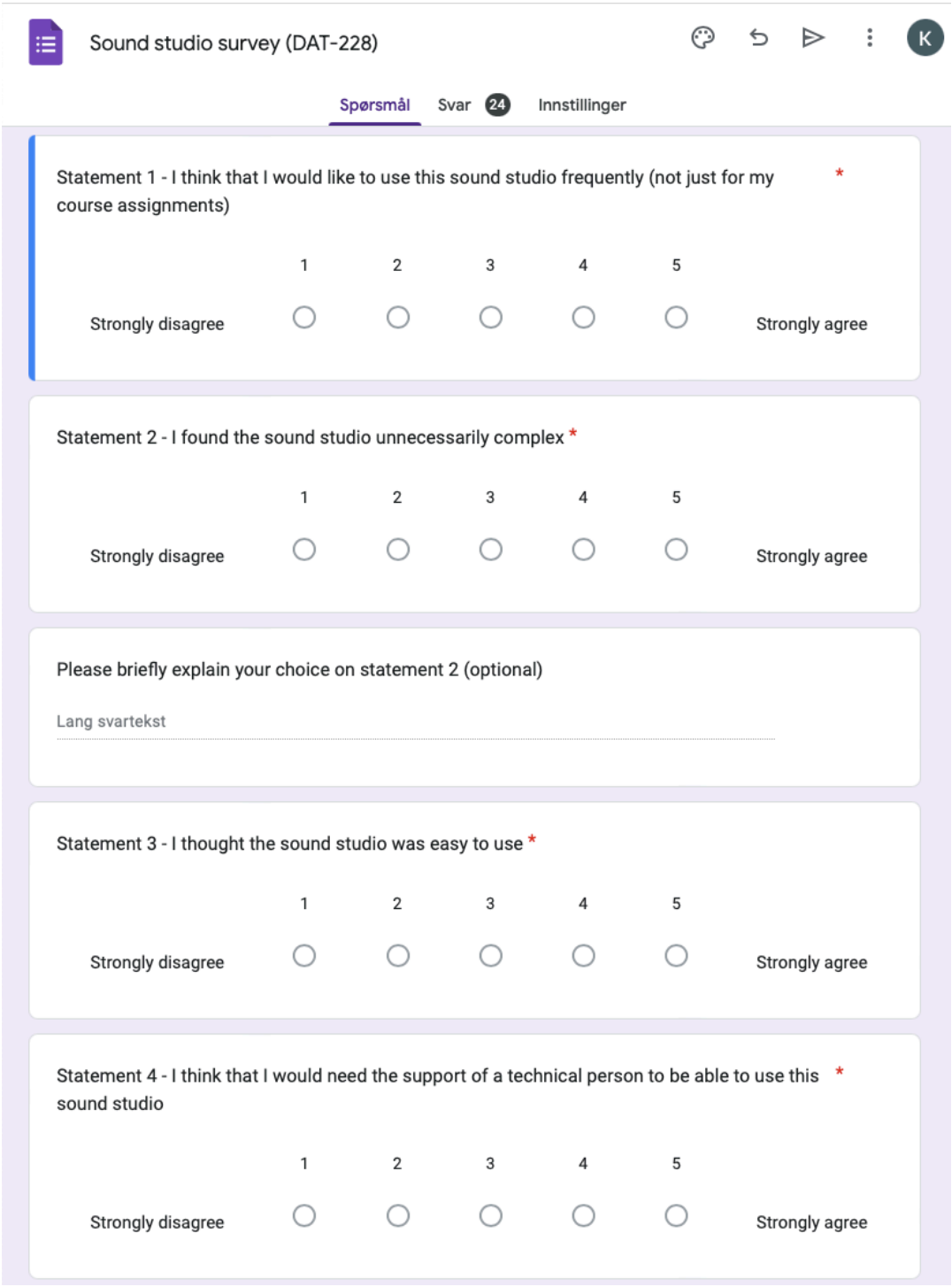

Figure D1. Online survey items 1 to 4

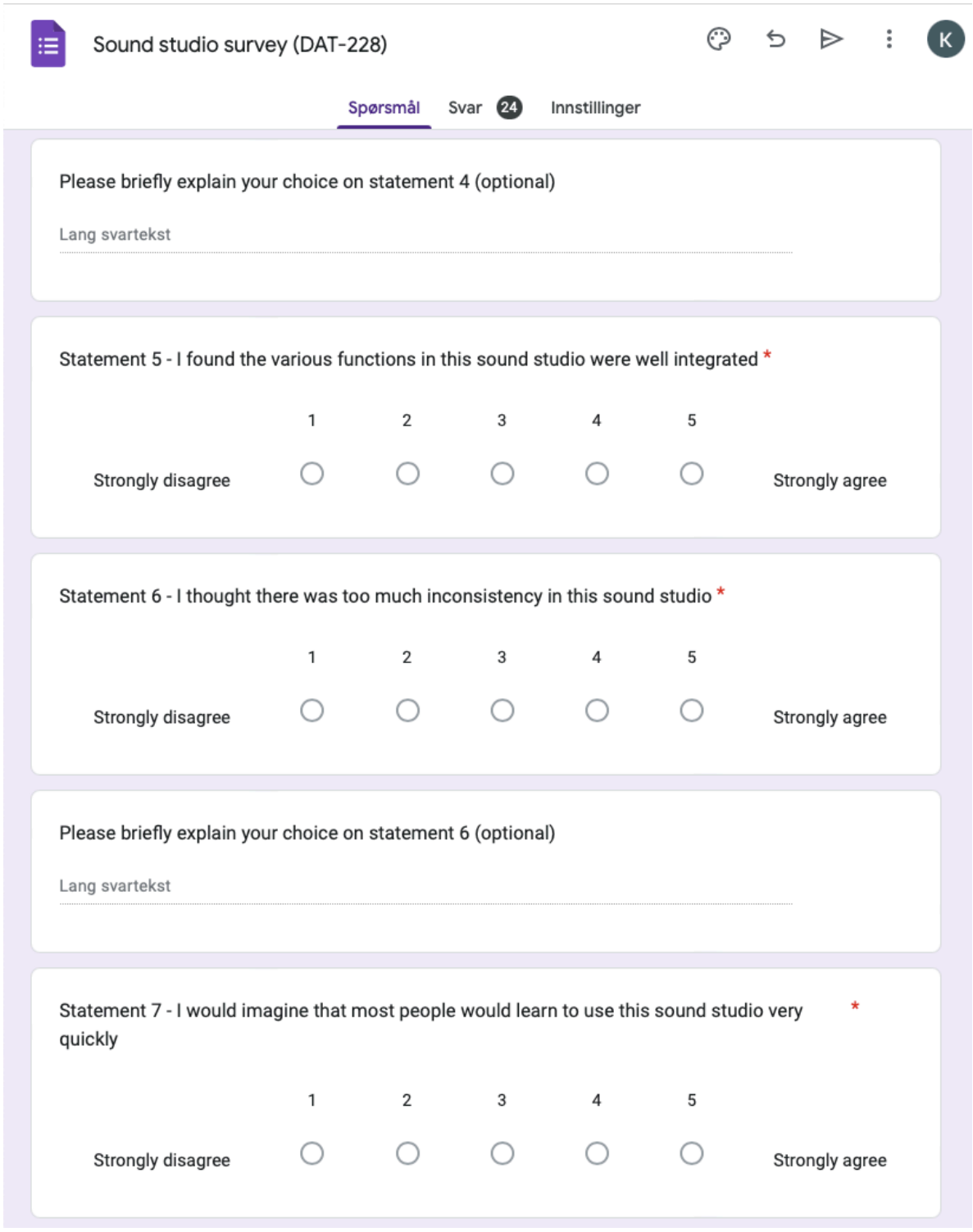

Figure D2. Online survey items 4 (open-ended) to 7

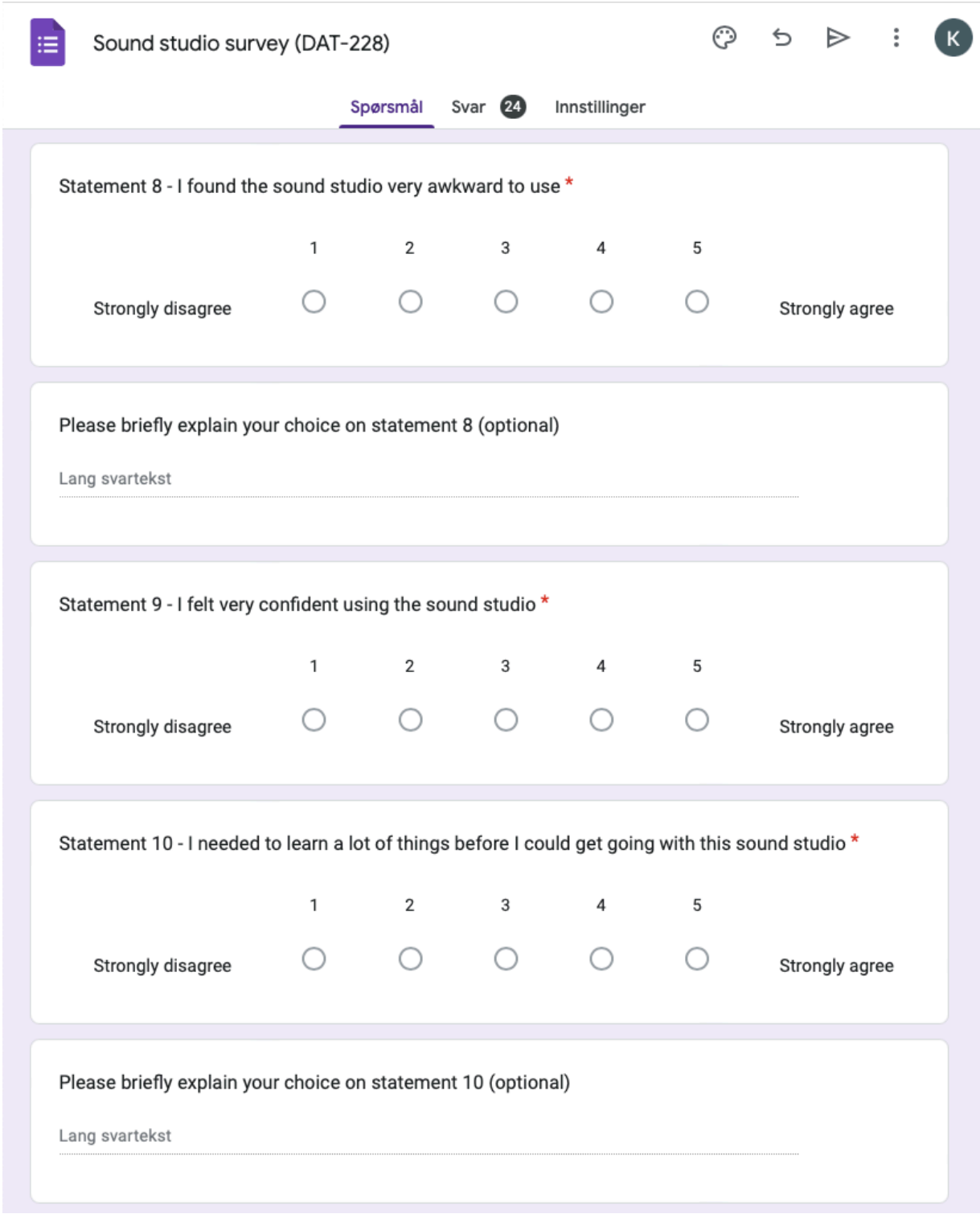

Figure D3. Online survey items 8 to 10 (open ended)

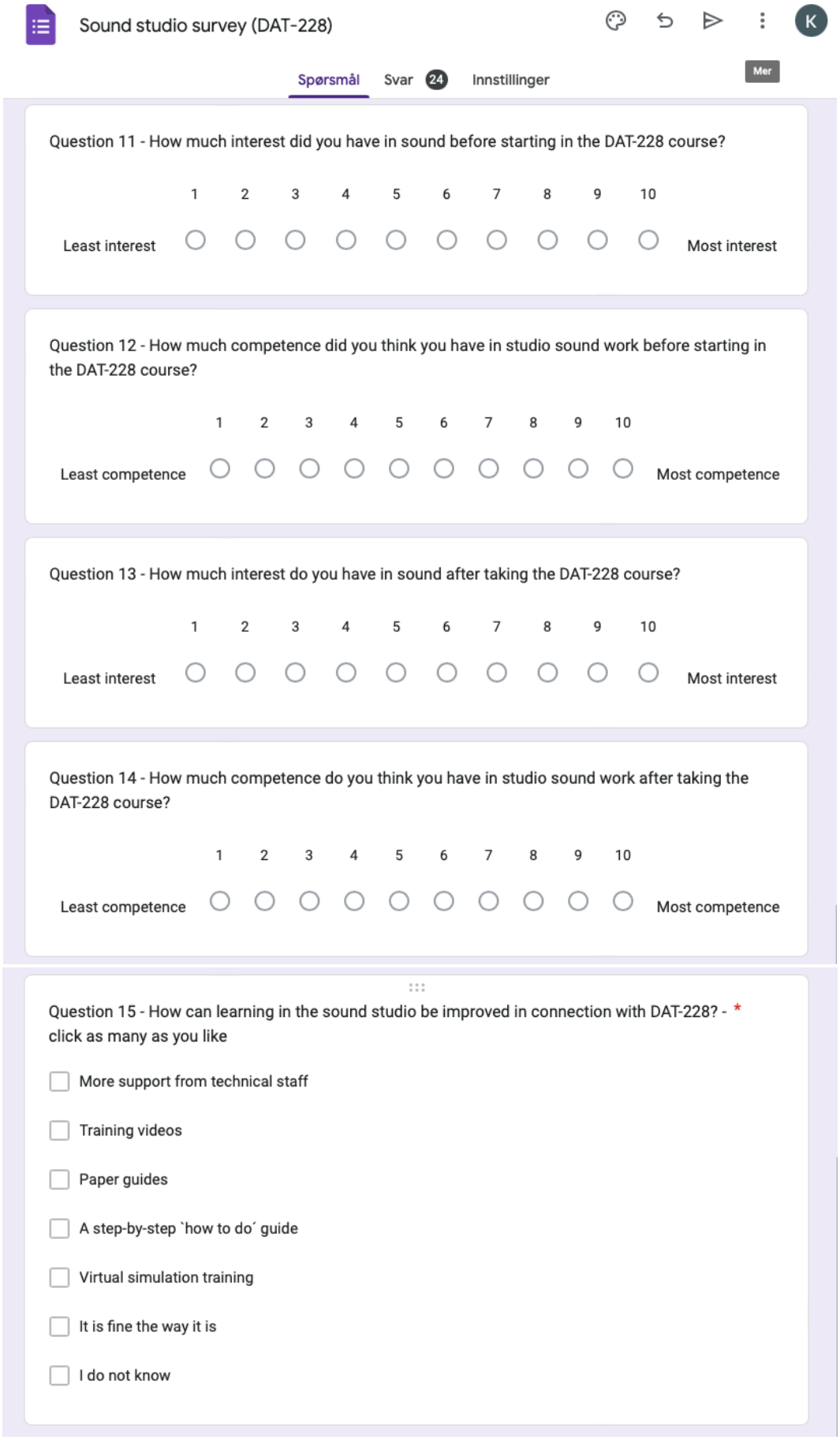

Figure D4. Online survey items 11 to 15

Appendix E – SUS results and Cronbach´s coefficient alpha

This appendix presents a breakdown of SUS results, as well as the variances that were used in the calculation of Cronbach´s coefficient alpha. Figure E1 shows the results for the control group, and figure E2 shows the results for the experimental group. Study participants are shown in the far-left column, from N1 to N24 for the control group, and N1 to N53 for the experimental group. Scoring relating to each SUS statement is shown in columns S to AB for the control group, and B to K for the experimental group. Each scoring result displayed has been converted to fit a scale of 0 to 4, according to Brooke (1996). Then on the right side is shown each total score per participant, followed by the SUS score when multiplied by 2,5. At the bottom of each SUS item is displayed the variance. The following formula was used for the calculation of the coefficient alpha:

$$\alpha = \frac{(K)}{(K-1)} \frac{Sy^2 - Sum\ Si^2}{Sy^2}$$

Where *a* stands for alpha*, k* for the number of items in the survey, *Si* for the sum of the individual variances, and *Sy* for the variance of the total scores. The execution of the formula in Excel was performed according to O´Loughlin (2021).

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD
1	**Control group**	**SUS S1 (X-1)**	**SUS S2 (5-X)**	**SUS S3 (X-1)**	**SUS S4 (5-X)**	**SUS S5 (X-1)**	**SUS S6 (5-X)**	**SUS S7 (X-1)**	**SUS S8 (5-X)**	**SUS S9 (X-1)**	**SUS S10 (5-X)**	**Total points**	**SUS Score Total x 2,5**
2	N1	0	2	1	3	3	3	0	0	1	0	13	32,5
3	N2	2	3	3	2	1	2	3	3	1	1	21	52,5
4	N3	2	3	3	2	2	4	2	4	3	4	29	72,5
5	N4	2	3	2	3	3	3	1	3	4	2	26	65
6	N5	3	1	4	3	2	4	2	3	2	2	26	65
7	N6	1	3	2	1	2	2	3	2	2	1	19	47,5
8	N7	2	1	2	1	3	4	2	1	0	1	17	42,5
9	N8	3	4	4	4	4	4	3	3	4	4	37	92,5
10	N9	2	3	2	1	3	2	3	3	3	2	24	60
11	N10	3	0	3	3	2	4	1	2	3	1	22	55
12	N11	2	2	3	2	2	3	3	2	2	2	23	57,5
13	N12	1	4	2	3	3	2	3	3	2	1	24	60
14	N13	3	1	2	2	3	2	2	1	1	3	20	50
15	N14	2	2	1	1	2	3	1	2	1	0	15	37,5
16	N15	3	2	2	1	3	3	1	1	1	1	18	45
17	N16	1	2	1	0	1	2	2	3	0	0	12	30
18	N17	0	2	2	2	3	2	3	3	1	2	20	50
19	N18	2	3	3	1	3	2	3	2	1	1	21	52,5
20	N19	1	3	3	2	3	2	2	2	2	1	21	52,5
21	N20	2	2	3	0	3	3	2	3	2	1	21	52,5
22	N21	1	3	3	4	3	3	4	3	3	3	30	75
23	N22	1	3	2	0	2	2	3	2	2	2	19	47,5
24	N23	3	3	2	1	2	3	2	3	2	1	22	55
25	N24	0	2	0	0	4	4	1	2	0	0	13	32,5
26												32,6793478	
27	Variance for each SUS item	0,97826087	0,94021739	0,91123188	1,5	0,60144928	0,66666667	0,92753623	0,84057971	1,30253623	1,304347826	9,97282609	
28													53,4375
29		X indicates the score given by the participant				Alpha Control group	Formula Cronbach´s alpha =(10/9)*((AC26-AC27)/AC26)			AC26 represents the variance for the sum of the scores. AC27 represents the sum of the individual variances			Control Group mean SUS score
30						0,77203097							

Figure E1. SUS results and coefficient alpha calculations for the control group

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Experimental group	SUS S1 (X-1)	SUS S2 (5-X)	SUS S3 (X-1)	SUS S4 (5-X)	SUS S5 (X-1)	SUS S6 (5-X)	SUS S7 (X-1)	SUS S8 (5-X)	SUS S9 (X-1)	SUS S10 (5-X)	Total points	SUS Score Total x 2,5
2	N1	0	2	1	3	4	3	4	1	1	1	20	50
3	N2	4	4	3	2	4	3	3	4	3	3	33	82,5
4	N3	1	2	1	1	0	2	0	1	1	0	9	22,5
5	N4	3	3	2	2	4	4	4	4	2	1	29	72,5
6	N5	2	2	3	3	3	3	3	3	2	0	24	60
7	N6	3	4	3	2	4	4	2	3	3	3	31	77,5
8	N7	2	3	2	3	4	4	3	4	1	2	28	70
9	N8	1	4	2	2	3	4	3	2	2	1	24	60
10	N9	3	4	3	3	3	4	3	3	2	2	30	75
11	N10	1	4	4	1	3	0	2	4	2	0	21	52,5
12	N11	2	4	3	3	3	4	4	4	3	3	33	82,5
13	N12	4	4	4	4	4	4	2	4	4	3	37	92,5
14	N13	2	3	2	2	3	4	2	3	2	2	25	62,5
15	N14	3	1	3	1	3	1	3	1	3	1	20	50
16	N15	3	2	2	3	2	4	3	4	3	3	29	72,5
17	N16	2	3	3	1	4	4	2	2	2	3	26	65
18	N17	4	0	4	4	4	4	3	4	4	4	35	87,5
19	N18	4	3	4	2	3	4	4	4	3	1	32	80
20	N19	2	4	1	2	3	4	1	2	3	1	23	57,5
21	N20	2	4	1	4	3	4	1	2	3	2	26	65
22	N21	3	4	3	3	4	4	4	4	4	4	37	92,5
23	N22	3	3	3	4	3	4	3	3	2	0	28	70
24	N23	3	2	2	3	3	4	3	4	3	3	30	75
25	N24	3	2	2	2	3	3	1	2	2	2	22	55
26	N25	3	3	3	0	4	4	4	4	3	2	30	75
27	N26	4	3	2	1	2	4	1	2	1	1	21	52,5
28	N27	3	2	3	1	3	3	2	4	1	2	24	60
29	N28	2	4	1	2	3	3	1	2	0	0	18	45
30	N29	2	4	3	2	4	4	2	2	2	2	27	67,5
31	N30	0	4	3	2	4	4	4	4	2	3	30	75
32	N31	3	2	2	2	2	2	1	1	3	0	18	45
33	N32	3	0	2	2	2	3	2	1	3	1	19	47,5
34	N33	2	0	2	3	2	3	1	1	3	0	17	42,5
35	N34	3	3	2	3	3	4	3	4	2	2	29	72,5
36	N35	2	3	2	2	3	2	2	2	2	2	22	55
37	N36	1	4	2	3	2	4	3	3	2	2	26	65
38	N37	2	3	2	3	4	4	2	3	3	2	28	70
39	N38	2	3	2	3	2	3	2	3	2	2	24	60
40	N39	4	4	2	3	3	3	4	4	3	3	33	82,5
41	N40	2	3	3	4	4	2	2	4	3	0	27	67,5
42	N41	2	2	1	3	3	2	2	3	2	2	22	55
43	N42	2	4	3	2	2	2	2	2	2	4	25	62,5
44	N43	4	4	2	1	2	3	3	1	1	0	21	52,5
45	N44	3	3	3	2	3	4	2	4	2	2	28	70
46	N45	4	2	3	3	4	4	4	3	3	0	30	75
47	N46	2	1	2	2	3	3	3	2	2	2	22	55
48	N47	3	2	3	3	2	3	2	3	2	2	25	62,5
49	N48	2	4	3	4	4	4	3	4	3	1	32	80
50	N49	2	4	3	4	3	4	4	4	3	3	34	85
51	N50	3	4	2	4	2	3	4	3	4	3	32	80
52	N51	3	3	2	1	3	3	3	4	3	3	28	70
53	N52	3	3	2	4	3	3	3	2	3	2	28	70
54	N53	3	3	2	3	3	3	2	2	2	2	25	62,5
55												30,388244	
56	Variance	0,946299	1,263425	0,632075	1,023948	0,690856	0,798984	1,058055	1,179245	0,743832	1,35994194	9,696662	
57													65,89622642
58		X indicates the score given by the participant				Alpha 0,756564	Formula Cronbach´s alpha =(10/9)*((L55-L56)/L55)			L55 represents the variance for the sum of the scores. L56 represents the sum of the individual variances			Exp. group mean SUS score
59													

Figure E2. SUS results and coefficient alpha calculations for the experimental group

Appendix F – t-test of the observed difference in SUS

	A	B	C	D	E
1	Control group	Experimental group	t-Test: Two-Sample Assuming Unequal Variances		
2	32,5	50,0			
3	52,5	82,5		*Experimental group*	*Control group*
4	72,5	22,5	Mean	65,89622642	53,4375
5	65,0	72,5	Variance	189,9265239	204,2459239
6	65,0	60,0	Observations	53	24
7	47,5	77,5	Hypothesized Mean Difference	0	
8	42,5	70,0	df	43	
9	92,5	60,0	t-Stat	3,582554994	
10	60,0	75,0	P(T<=t) one-tail	0,000430613	
11	55,0	52,5	T-Critical, one-tail	1,681070703	
12	57,5	82,5	P(T<=t) two-tail	0,000861225	
13	60,0	92,5	T-Critical, two-tail	2,016692199	
14	50,0	62,5			
15	37,5	50,0			
16	45,0	72,5			
17	30,0	65,0			
18	50,0	87,5			
19	52,5	80,0			
20	52,5	57,5			
21	52,5	65,0			
22	75,0	92,5			
23	47,5	70,0			
24	55,0	75,0			
25	32,5	55,0			
26		75,0			
27		52,5			
28		60,0			
29		45,0			
30		67,5			
31		75,0			
32		45,0			
33		47,5			
34		42,5			
35		72,5			
36		55,0			
37		65,0			
38		70,0			
39		60,0			
40		82,5			
41		67,5			
42		55,0			
43		62,5			
44		52,5			
45		70,0			
46		75,0			
47		55,0			
48		62,5			
49		80,0			
50		85,0			
51		80,0			
52		70,0			
53		70,0			
54		62,5			

Figure F1. t-test results for SUS observed difference performed in Microsoft Excel

Appendix G – Transcripts from experimental group interviews

All group interviews took place after the studio sessions were completed and the students had submitted their responses in the survey. The location was the multimedia common room, just next to the sound studio. Interviews lasted approximately 10 minutes on average.

KK = Konstantinos Kokogias

G1 - Group 1

Date: 30.08.2022
Number of participants: 3

KK: How was your experience today in the studio?
Student 1: It was overwhelming. With so many dials and so many switches. Some newer microphones come with their own program where you can dial in EQ and compression, it is a lot simpler. But after a few visits to the studio, I think it would get a lot easier.
KK: Do you mean that they come with presets in software?
Student 1: Yes, it's almost automatic. It feels very different, I found.
KK: Do you mean that the process of making manual adjustments and making decisions, is a bit complex?
Student 1: Yes, it is a lot more comprehensive in more simple programs, designed much more for simplicity. And this (the sound studio) is a lot more complex, but there is a lot more to play with, I guess.
KK: Anybody else?
Student 2: Jeg synes jeg er ganske enig med det han sier. Det er litt vanskelig i starten, men jeg tror at hvis du bare er her et par ganger, så lærer du fort. Men det er mye knapper og ting og tang du må sette deg inn i.
KK: Was there a specific area for you that was complicated? Hardware, software, or both?
Student 2: Software er greit, men hardware, det med å finne ut av alle disse kompressorene, og det å finne balansen mellom de forskjellige tingene.
Student 3: Jeg tror hvis `knobs´ og alt fra før hadde ikke vært satt opp fra før, så hadde det vært mye vanskeligere. Da måtte du faktisk ha justert alt selv. Det er jo en milliard knapper, og hjul og ting. Men nå har jeg heldigvis brukt dette litt, så da er det bare å skru på.
KK: Have you used the same or similar units before?
Student 3: På en måte. Jeg har bare skrudd på en høyttaler, og plukket opp mobilen og spilt av musikk. Det er egentlig alt.
KK: And how did you guys find the course in Canvas?
Student 2: Jeg synes det var ganske greit. Rask og enkelt. Det er veldig greit at en kan gå gjennom videoene flere ganger, og se hvordan du gjør det, hvis du glemmer det ut.
Student 3: Det funket ikke så bra på min ultrawide skjerm. Det ble en sånn tynn stripe på bunnen, hvor jeg ikke kunne se toppen og bunnen, for det ble `stretched´.
Student 1: Det var en sånn VR-funksjon, så du kunne navigere. Jeg synes det var litt rart og unødvendig med den VR-funksjonen.

KK: The function showing the studio, the control room, or both?
Student 1: Both. Some of the text boxes would not be visible on the screen. So, you had to navigate upwards to see the whole text box. I think a more standard way of showing it would be better.
KK: When you say standard, you mean?
Student 1: Det var fint å ha selve bildet der, men å klikke og dra oppover, på grunn av VR-funksjonen, var litt unødvendig, synes jeg.
KK: Mener du at det hadde vært enklere å bare klikke på en ting og lese med en gang, uten på en måte..
Student 1: Å justere vinduet rett og slett, det samme når det kom til spørsmålene. Det kom opp litt sånn rart perspektiv, så det var noen gang litt vanskelig å lese hva som var. Men det at man kunne se på videoene i fullskjerm, det var ganske greit.
Student 3: Det var også greit at når du en gang var ferdig, så du at du fikk poeng. På andre quizer, så tar det ofte litt tid før du faktisk får den scoren registrert.
KK: Mener du en typisk quiz på Canvas?
Student 3: Ja, du tar en quiz, så får du en mail to timer senere hvor det står at det er vurdert, selv om det egentlig går automatisk.
Student 1: Fikk det her også, men du fikk jo også svaret med en gang. Det er greit.
KK: Så dere fikk tilbakemelding med en gang at dere hadde bestått quizen.
Student 1: Ja, og så fikk jeg mail senere om at det var vellykket.
KK: Via Canvas?
Student 1: Ja, via Canvas.
KK: What was the impression of being virtually `present´ in the studio? Did it make a difference or not?
Student 1: It helped, but I think that with all the question marks and the text boxes, it got a little cluttered for me. But it was nice to view the whole studio and the control room.
KK: How would you have done it differently?
Student 1: I think for the quiz part and the text boxes I would have kept them in 2D, either down on the page or in their own separate 2D space.
KK: How did the playback of videos go?
Student 3: Da jeg trykket feil, så prøvde jeg å gå tilbake. Jeg vet ikke om den `crashet´, men ingenting funket. Så prøvde jeg å `refreshe´, og så kom den tilbake på starten. Men den hadde registrert at jeg hadde trykket på de videoene. Så da jeg trykket videre, så var det de forrige spørsmålene mine. Jeg trodde at alt måtte komme på nytt, men da jeg kom til der jeg hadde svart feil, så prøvde jeg å svare riktig, men det funket ikke.

G2 - Group 2

Date: 30.08.22
Number of participants: 4

KK: Can we begin by discussing how you experienced the overall solution in the studio?

Student 1: Fysisk i studioet, synes jeg var veldig fint. Det var veldig lett å finne fram. Spesielt fordi vi visste på forhånd hvor ting var. Det var litt mer å orientere seg innenfor i kontrollrommet.
Student 2: Og huske på.
Student 1: Og huske på, ikke minst. Og det at komponenter har blitt byttet ut. Hvis ikke du er en lydperson, så vet du sannsynligvis ikke hva boksen er i utgangspunktet. Så da blir det litt sånn, ¨hva er det der? Skal jeg bruke den? ¨.
KK: Snakker du om AD/DA-konverteren?
Student 1: Ja, kjente den ikke igjen. Jeg er ikke en lydperson, da har du fjernet en komponent som hjernen min bare ikke har registrerer. Den boksen som er ny som står der, den skal jeg ikke bruke, fordi jeg har ikke sett før.
KK: Men, faktisk det finnes et bilde av det på kurset.
Student 1: Det er ikke et bilde av den.
Student 2: Men, bilde av hva?
Student 1: Den forsterkeren på venstre side.
Student 2: Den lille?
KK: AD/DA-konverteren. Lynx Aurora.
Student 2: Den her? (She checks the digital resource on her mobile phone)
Student 1: Få se.
Student 2: Den ser vi.
Student 1: Det der (in the studio) ser ikke sånn ut (on the picture in the course).
Student 2: Jo. Det er bare denne henger sammen som en.
Student 1: Ja, men der ser du et svart panel.
Student 2: Ja, men det er den på siden her, ikke det? Det ble nevnt i quizen.
Student 4: Jeg kjente den.
KK: Det sto på en info-hotspot. Så fikk man det bildet da man klikket på det.
Student 1: Men, den som står der inne i kontrollrommet, er så stor. Det virker liten på det bildet der, i forhold til virkeligheten.
Student 2: Man trodde at den var mindre. Når vi gikk gjennom de boksene i kontrollrommet, så føltes de ganske stor i min mening.
Student 3: `Overall´ synes jeg det var veldig fint. Når vi var inne i lydstudioet, så følte jeg at vi bare måtte orientere oss bittelitt kjapt om hvor ting var. Men så husket vi veldig mye fra videoene. For eksempel inn i skapet. ¨Ja, der var mikrofonen og det man trengte der. Så var jo kablene der borte. Og den koblingsboksen der nede¨. Så det med den 3D-visningen der inne, følte jeg funket veldig bra. For da visste man hvor ting var uten å ha vært der før. Og så blir det ikke så mye stress at noen begynner å lete rundt. Du vet hva det er som er koblet. Der inne foran PC-en var det også greit. Det var litt annerledes enn det som var på kurset. For da fikk noen andre gjøre det for deg. Det var litt annerledes å gjøre det selv.
KK: Mener du direkte i Logic eller å sende signal til Logic?
Student 3: Egentlig begge deler. Logic kunne vi for så vidt teste litt hjemme også. Men de boksene som var der, forsterker og sånt.. Mest var det greit. Det eneste var den siste der, som vi nevnte den på venstre siden. Som jeg heller ikke hadde fått med meg. Følte på en måte det var noe vi hadde glemt. Men så kjente heller ikke jeg på en måte hele den boksen igjen. Men vi fant ut av det da.

Student 1: Vi diskuterte det faktisk tidligere. Fordi det sto i kurset noe om AD/DA-konverteren, ¨er det den, eller den? Det (in the studio) ser ny ut, så forholder vi oss ikke til¨.
Student 3: Jeg synes det var veldig ok å få være her og prøve litt. At vi fikk prøve begge deler. Og teste litt, og se hvordan ting funket. Og sånn videre til å lage prosjekt. At nå går det ganske greit. Nå vet vi også om vi får koblet det opp. Så vet vi ganske greit at vi får tatt opp lyd i hvert fall. Og litt med de signalene, at vi fikk teste det litt selv. Det synes jeg var egentlig veldig ok. Quizene underveis i forhold til den e-læringen, synes jeg også var veldig fine. Det eneste var at jeg ikke skjønte helt, hva de spurte på et spørsmål. Det var det..
KK: Det om `plosiver´ hvis jeg husker riktig hva du nevnte før?
Student 3: Det var plosivene, i forhold til hva pop filter hjalp for. For da skjønte jeg ikke hva de spurte med det ordet som han sa. Så den misforstod jeg litt. Og det eneste ellers var vinduet på videoen. Jeg prøvde å zoome litt inn og ut, så det skulle bli litt større. Og da ble teksten litt uklar. Prøvde å styre litt med det.
KK: Det høres ut som at noe gikk feil med integrasjonen mellom Adobe Captivate og Canvas.
Student 3: Men det gikk greit. Det var bare noen ting som var litt små. Så da måtte jeg zoome ut til det var 90 eller 100 prosent, så det ble klart. Når man zoomer inn eller mer ut, så endrer vinduet seg litt. Og da ble noe av teksten uklar. Men ellers så synes jeg det var et veldig fint opplegg. Funket bra. Følte meg forberedt når jeg kom i dag.
Student 4: Da jeg tok quizen for første gangen jeg ikke visste at jeg kunne snu rundt. Så jeg kunne ikke lese et av spørsmålene helt, så jeg bare gjettet. Så jeg fikk feil på den ene, for jeg kunne ikke lese spørsmålet. Men så fant jeg det ganske kjapt ut på den andre, det var ikke så vanskelig.
Student 2: Jeg synes det var greit oppsatt i både lydstudio og foran PCen. For meg er det ganske ukjent, og man har bare satt og lest på det. Da er det veldig mange grå knapper, som jeg ikke helt vet hva jeg stiller opp eller ned. Du må bare prøve deg fram. Det var egentlig bare sammenhengen. Men det gikk jo greit etter hvert, sånn at du fikk sette deg inn i det og skjønne hva som flyttet på hva.
Student 4: Ja, det gikk greit for oss etter at vi fant ut at vi måtte trykke et sted på programmet. Vi måtte trykke på det lydikonet, så vi så at den skiftet. Det var bare det vi hadde glemt. Så da ga det alt mye mer mening når vi prøvde å justere til -12dB, når det stod helt på -7 og ikke skjønte helt hva feilen var. Men ja, det var bare å trykke på den og aktivere. Og da kunne man se og justere.
KK: Skjønner, sammenhenger mellom handlinger.
Student 2: Ja, at en ting kan gjøre at andre ting virker litt forvirrende. Og jeg trodde jeg gjorde rett, men så kunne ikke jeg si at den skiftet seg. Det så enkelt ut å forstå på videoene i kurset.
KK: Hva synes dere om kurset hadde blitt delt opp til enda flere mindre deler, eller om introduksjonsøvingen var delt opp i to økter? Da kunne man for eksempel ta den delen om kompresjon en annen gang.
Student 1: Jeg tror at hvis vi hadde vært helt alene der inne (in the studio), så hadde vi sutret veldig lenge. Fordi det er veldig mange ting å huske på. Men når det er veiledning, så føler jeg egentlig at det går greit. Det er litt som å kaste barn ut i bena når de ikke kan svømme. Så lære dem å svømme.

Student 3: Jeg synes det er ok å få se de videoene og komme litt forberedt. Og så få gjøre noe av det samme mens vi er her fysisk. For da har du lært to ganger. En teoretisk gang og en praktisk gang. Og så får du teste litt andre ting. Hvis det er noe man er usikker på, etter å ha bare sett kurset, så kan man faktisk teste det her, eller spørre deg (the teacher). For jeg føler at du får gjennomgang to ganger. Jeg tror jeg kommer til å huske det bedre neste gang jeg skal til lydstudio nå, enn hvis jeg bare hadde vært der en gang. Eller hvis jeg bare hadde sett videoene. For jeg tror det er at du har hatt to ganger. At man føler at man kommer litt forberedt. At man kan noe, og så kan man gjøre det igjen. Så lærer man seg det, og vet litt om det fysisk. Det tror det er en veldig fin måte, i hvert fall for meg, og huske på.
KK: How was it with the 360-function? That you could look around the room instead of looking at a flat image.
Student 4: Det var bra, fordi du skjønte litt mer hvor ting var i rommet. Fordi du kunne bevege deg rundt. Hvis jeg hadde kommet hit og bare sett på 2D bilder, så hadde det vært sånn, ¨det er cirka der¨. Men, det er ikke sånn, det er ¨ok, det er i det hjørnet¨.
Student 2: Ja, det er veldig sant. Og så synes jeg mengden var ganske grei. Det vi måtte gjøre. Det synes jeg ikke burde ha vært mindre. Synes det var akkurat passe.
Student 3: Det var heller ikke kjempelangt. Det var sånn at man kunne se en video, og så fokusere, og så ta quizen. Og så kunne du på en måte se en til, og så kunne du ta en liten pause. Det var passe.
KK: Hvordan gikk det med avspilling av videoene forresten?
Student 1: Jeg fikk små stopp i filmene. Når jeg så dem inne i 3D-rommet.
Student 4: Jeg tror det var nettproblemer med meg, for jeg hadde det samme. Vi har ofte problemer med nettet, så det var derfor jeg tenkte at det var bare nettet.
Student 1: De små stoppene der, det var sånn, du er inne i 3D-rommet, så trykker du på videoen, så begynner den å spille, så stopper den bare plutselig, og så måtte du trykke på play igjen. Og så begynte den å spille, så stoppet, så måtte du trykke på play igjen.
Student 3: Jeg opplevde en ting, og det var når jeg prøvde å zoome inn og ut, for å få det litt opp og ned. Da fikk det påvirke videoen, så på en måte hang litt etter. For da gikk stemmen først, og etterpå så det at ting skjedde litt sakte. Jeg tror at lyden gikk som vanlig, men selve bevegelsen på skjermen, skjedde litt i etterkant. Jeg ble plutselig forvirret, for da sa læreren noe, og så skjedde ingenting på skjermen, og så gikk det på neste tema, og så kom bevegelsen fra før.
KK: Any other comments about experiences with the studio or the digital resource?
Student 1: Jeg ville ha brukt veldig lang tid på dette alene. I hvert fall inne på kontrollrommet, med alle knappene du skal huske på. Og det at jeg kanskje ikke kjenner igjen sånne forskjellige typer bokser, annerledes enn de fra bildene, som man har sett i det kurset. Jeg måtte lete etter dem og finne ut hvilken seksjon de ligger i. Så blir det veldig mye knoting før jeg skal tilbake til det jeg skal til igjen. Så hvis det er noe som kan være en giveaway, for folk som ikke har noen erfaring med lydtinger..jeg vet hva en gitar er, jeg vet hva en høyttaler er, og det stopper der. Så det å komme inn i et slikt rom, det er overveldende. Fordi alt ser likt ut.
Student 3: Jeg synes det var veldig fint at det var en gruppe, at vi kunne være en gjeng som gikk sammen. Og når vi delte opp to og to, så var det passe med to i lydstudio og to i kontrollrommet. For da var det sånn, jeg var jo litt usikker på noen ting, men vi kunne på en

måte hjelpe hverandre. Og så snakket vi litt sammen, og så drøfta vi litt, og så fant vi ut av det. Det gikk egentlig greit med alt, vi måtte bare snakke litt sammen først. Så det var fint samarbeidsmessig også, for da får man jo læring ut av det også. Ting man kanskje er litt usikker på selv, så kan man snakke litt om det, og så vet kanskje den andre, eller husker den andre, en ting som du har glemt, så får du litt læring der også. I tillegg til at du er der selv, og så tester du ut.
Student 1: Ja. Det synes jeg var veldig fint.
Student 3: Jeg likte også at det var gruppe, og jeg synes det var ganske greit.
Student 4: Samme her.

G3 - Group 3

Date: 30.08.22
Number of participants: 4

KK: Kunne vi snakke litt om hvordan dere opplevde den fysiske løsningen i lydstudio og kontrollrommet? Var det greit, eller forståelig, eller komplisert?
Student 1: I kontrollrommet, så er det veldig mye å ta inn med en gang. Men det er vel kanskje forventet det. Det er veldig mye utstyr som gjør forskjellige ting, som er koblet til forskjellige ting. Så det bare tar litt tid med å forstå det. Men selve studio så var det jo relativt lett å sette opp.
Student 2: Jeg er enig. Det var greit å komme fysisk, man lærer av det. Så det er mye bedre enn å bare sitte på PC og se på videoer og følge med. Å prøve noe, så man lærer av det fortere og ikke glemmer det. Så det var greit.
Student 1: Definitivt vanskeligere hvis vi ikke har hatt en fysisk del. Hvis vi bare ble dyttet inn i studioet uten noe hjelp.
Student 3: Hvis det bare ha vært det kurset vi tok tidligere, så hadde jeg aldri klart å gjøre det ordentlig. Da hadde jeg glemt halvparten, men nå har jeg gjort det fysisk. Så lærte jeg at den knappen var det som ble nevnt på kurset, og så koblet det jeg gjorde i studioet mot det.
Student 2: Det er samme med mikrofonen. Når vi setter opp mikrofonen, så snakker vi om at mikrofonen må være rett, og justert sånn. Så det er mye lettere å gjøre det fysisk. Så det er ting bedre med studioet.
KK: Hvordan var det å oppleve lokalen digitalt før dere kom inn?
Student 4: Husker litt mer hvor ting var når jeg hadde sett det litt på forhånd. Husker ikke alt, men husker litt hva ting var.
Student 1: Det er lettere å orientere seg når man vet hvor tingene befinner seg.
KK: Hvordan var det å bruke de 360 bildene?
Student 1: Det hjalp, jeg benyttet meg av det.
Student 3: Det var nyttig å se når vi skulle koble inn mikrofonen i veggen, at det er på veggen der, men så ser den sånn ut. Det hjelper litt.
KK: Fikk dere forresten noen problemer med den digitale ressursen, for eksempel avspillingsproblemer med videoene?
Student 1: Nei, de spilte veldig greit for meg.

Student 4: Jeg merket bare at de var litt hakkete de videoene, og så var de litt små. Jeg klarte ikke til å gjøre de større, så det var vanskelig å se litt.
KK: Hva er deres tanker om hvordan opplevelsen kunne forbedres?
Student 1: Jeg tror kanskje ikke de videoene trenger å være i den 3D-verden. Det kan være eksternt uten noen problem.
Student 4: Det kan hende det tar litt mye å prosessere det og at det er derfor videoene kan bli litt tregere, at selve programmet blir litt tregere. Det blir litt mye.
Student 1: Men å ha de her små spørsmålstegnene som pekte til hva dette var, fungerer ganske bra. Det peker ut hvor ting var. Det blir lettere når du skal sette deg ned og gjøre ting rent fysisk.

G4 - Group 4

Date: 01.09.22
Number of participants: 4

KK: Kan vi diskutere litt om hvordan dere opplevde den fysiske løsningen her i studio og kontrollrommet.
Student 1: Veldig profesjonelt derfor.
Student 2: Synes det var veldig ryddig. Ting var plassert ganske lett tilgjengelig for enhver ny person som ankommer studioet.
Student 3: Det er så lett å finne alt utstyr og så sette opp prosjekt på PCen og bruke de programmene. Litt vanskelig med å bruke Audition, men lettere med Logic.
KK: Hvordan var det med å først ta ressursen i Canvas og så være her fysisk?
Student 2: Jeg synes det hjelper en del. Når du gikk gjennom de videoene blant annet, da fikk du jo en god forståelse for hvordan du satt opp det meste her. Jeg synes videoene og den quizen hjalp ganske mye.
Student 1: Jeg tror det hadde gått veldig mye saktere i dag hvis vi ikke hadde sett de på forhånd. Men nå visste vi jo mye selv. Så måtte vi finne ut av litt ting da. Det er bra da, da lærer man.
KK: Hvordan var det med 360-funksjonen? Det med at man kunne skikke rundt litt.
Student 2: Jeg gjorde det på mobilen, så jeg så ikke så veldig mye rundt meg. Men jeg tror det hadde vært så å si helt likt om du bare hadde tatt bilder inn i studio og selve kontrollrommet. Jeg tror ikke det gir noe mer funksjon med den 360. Men det var jo kult da.
Student 1: Det var det. Det var på et tidspunkt at jeg brukte den, og det var når de spurte hvilken preamp går inngang 3 til. Det var jo det spørsmålet. Og da var det jo den nederste venstre, ikke sant? Og da sveipet jeg faktisk rundt i rommet på bildet for å se den kompressoren. Det var det eneste gangen jeg brukte den. Det hadde en funksjon, kan man si. Men det var kult, det var det. Ellers så tror jeg det hadde klart seg med et 2D-bilde.
KK: Ikke mye å kikke rundt i kontrollrommet med 360?
Student 1: Nei, jeg snudde rundt bare for å se. Men det var ingenting å se bak. Kanskje hvis det hadde vært et spørsmål til det som var bak..
Student 2: Det som var rundt i rommet?

Student 1: Ja, det var jo det. Men der du faktisk trengte å se, kanskje. Så hadde det vært mer nytte.
Student 2: Du kunne kanskje ha plassert spørsmål rundt i rommet, i stedet for å ha en quiz. For eksempel, her står mikrofonen, og så tar du spørsmål `hva er her? ´. Og så for eksempel, det er utgangen her på veggen. `Hva bruker du denne utgangen til? ´. Så går folk rundt, sveiper rundt eller trykker på ting i rommet, og så får de spørsmål om det rommet.
KK: Mener du å gjøre det enda mer lokalisert?
Student 2: Å gjøre det litt lettere for enkelte å huske også. Da husker du liksom spesifikt. Da forbinder du det spørsmålet med det stedet. Da husker du for eksempel, der er mikrofonen, der er kablene, der er ditt og da.
KK: Fikk dere avspillingsproblemer på Canvas? Med videoene.
Student 2: Ikke på videoene.
Student 1: Nei, det gikk fint. Det var et par ganger at det hang så litt i quiz-delen. Den hoppet ut av quiz-vinduet, egentlig. Det kan gå til at jeg bare var borte i noe, men jeg følte ikke at jeg var det. Den hoppet ut av quiz-vinduet, så måtte jeg gå inn igjen. Men det var ikke noe stort problem. Så jeg vet ikke helt hvorfor det skjedde. Om det bare var helt tilfeldig, eller ikke.
Student 2: Den er nok heller ikke så like godt optimalisert til mobil fremfor laptop, vil jeg tro. Jeg satt og gjorde det på mobil i går kveld, og tenkte det. Det føles ikke like godt med, sånn som jeg vil tro på PC.
KK: Noen andre ting som vi skulle tenke på med tanke på forbedring?
Student 2: Jeg kommer ikke på noe som kan forbedres. Jeg synes denne læremåten med fysisk læring, hvor man faktisk får den øvingen og hvor man går gjennom det og setter opp et prosjekt, er veldig bra. Jeg synes det er mye lettere å lære sånn fremfor å bare høre om det i en forelesning. Det er praktisk.
Student 1: Ja, det er praktisk, det er bra. Jeg har ikke noe særlig annet å tilføye, hva mener dere?
Student 4: Nei, jeg tenker det er greit. Den blandingen av å kunne se en ting og så gjøre det etterpå. Den balansen mellom det teoretiske og praktiske. Jeg synes det er ganske behagelig, for da får jeg sett det en gang, og så får jeg testet det en etterpå sett. Og da får du det litt inn i hendene.

G5 - Group 5

Date: 01.09.22
Number of participants: 4

KK: Kunne vi diskutere hvordan dere opplevde løsningen i studioet, den fysiske løsningen? Fra å sette opp mikrofon og så få signalet inn i opptaktsprogrammet. Var det komplisert eller var det forståelig nok? Hva er deres tanker?
Student 1: Det gikk greit, men vi glemte å slå på høyttalere og noen av maskinene.
KK: Den digitale ressursen i Canvas. Hvordan opplevde dere det?
Student 2: Du ser ting digitalt, men med en gang du er ferdig med det og du går inn på studioet, så får du faktisk fysisk gjøre det. Så det hjalp ganske mye.

Student 3: Jeg synes egentlig det var ganske greit å ta det rett før vi gikk inn, for da hadde jeg det fortsatt i minne. Hvis jeg for eksempel hadde sett det i går, så hadde jeg sikkert ikke husket like mye før jeg hadde gått inn i studioet.
Student 4: Men jeg synes det gikk litt fort, for jeg er ikke så god i å lære så fort. Så for meg var det litt vanskeligere at jeg tok det kort tid før jeg gikk inn i studioet.
KK: Hvordan kunne dette ha vært bedre?
Student 4: Jeg tror egentlig bare hvis jeg hadde brukt litt mer tid, så hadde jeg kanskje fått litt mer med meg. Det gikk litt fort. Men jeg synes opplegget var veldig bra.
KK: Var det en spesiell seksjon som var mer vanskelig å håndtere, eller? Var det noe som dere tenkte at dere kunne ha brukt litt mer tid på?
Student 2: Det var greit når man først skjønner det. Når man først kommer inn i studioet, og man ser såpass mange ting, så blir man litt overveldet. Bare ta det litt inn.
KK: Noen andre tanker?
Student 3: Jeg tror kanskje det kan se litt overveldende ut i starten, men med en gang vi prøver å slutte fram, selv om vi gjør feil i starten, så gikk det ganske greit når vi bare tenkte oss litt om det.
KK: Angående den digitale ressursen, kunne noen ting ha vært bedre eller enklere for dere?
Student 4: En ting jeg kan tenke meg er kanskje, fordi videoene er delt opp i tre seksjoner, hvis man hadde hatt en video, og så kanskje vært inne på, jeg vet at det er litt tidkrevende, men så video, og så vært inne på laben og faktisk sett det. For da får man lære, bruke, og så til neste video, og så lære, bruke. Men det fungerte ganske greit sånn som vi hadde også.
KK: Mener du på samme dag eller på forskjellige dager?
Student 4: Sånn som vi hadde nå, men i stedet for at vi så ferdig alle videoene, og så gikk vi inn, at man ser en video, og ha muligheten til å gå inn og på en måte gjøre det man nettopp så på.
KK: Skjønner nå. Noen andre tanker?
Student 3: Jeg likte veldig godt at det var veldig visuelle videoer, fordi jeg kan slite med å lære hvis det bare er en tekst. Så jeg likte veldig godt at man kunne se hva som skjedde i videoen.
Student 1: Enig.
Student 4: Enig, ja.

G6 - Group 6

Date: 07.09.22
Number of participants: 4

KK: Kunne vi diskutere litt om hvordan dere opplevde øvingen i dag, altså løsningen i studio, de forskjellige boksene og hele prosessen, hva virket bra, hva virket ikke bra, hva tenker dere?
Student 1: Jeg synes de videoene var greit lagt opp i forkant, men samtidig husker jeg ikke alt. Når du kommer til studio, så blir du veldig usikker med en gang, det er mange knapper, og det er mer en følelse som er litt skummel, men samtidig når du ser videoer og begynner å prate om det, så er det mye lettere. Så da synes jeg det var veldig greit å kunne sitte her i studioet, og at det var så kort tid etter vi hadde sett videoer.

KK: Mener du at det er viktig med kort tid før øvingen?
Student 1: Ja, at vi ser på det, at det ikke tar for lang tid, for man glemmer veldig fort.
Student 2: Jævlig, et kjempegodt eksempel for det da. Jeg husker ikke alt og så stresser jeg litt også da.
Student 3: Men det burde jo blitt kommunisert litt bedre i forkant, hvor viktig det var å se ordentlig de videoene.
Student 2: Ja, å se de ordentlig. Og så si det er viktig for det er dette du skal gjøre i studio.
KK: Tenker dere det var nok med to timer sånn som det var nå? Hva med flere timer? For å gå gjennom materialet og la det sitte litt inn i hodet før man tar i bruk den kunnskapen.
Student 3: Jeg tror at med fire stykker det er kanskje litt kort tid med to timer hvis alle skal prøve seg i begge ender.
KK: Hvordan var den digitale opplæringen for dere?
Student 2: Det var bra.
KK: Fikk dere problemer, for eksempel med tanke på innlevering av oppgavene eller quizene?
Student 3: Spørsmålene var greie, det var noen som lurespørsmål, som ikke på en måte egentlig ble nevnt i voiceover´en. Jeg prøvde på iPhone i går, for jeg var ikke hjemme, og så fikk jeg beskjed fra student 4 om at, `hei, vi må se disse videoene først´. Og jeg hadde bare iPhone tilgjengelig, og det funket dårlig.
Student 4: Ja, det funket ikke med iPhone. Jeg ikke svarte på spørsmål heller, for jeg var redd for quizen.
Student 3: Ja, og så kom det `error´, og så var det litt forsøk brukt opp.
Student 4: Ja, det skjedde samme på det første, så det var veldig vanskelig. Så jeg vil anbefale PC eller Mac, for å se det på.
Student 2: Det var bra på PC.
Student 1: Ja, der var det greit. Og det var bra at videoene varte ikke mer enn 3-5 minutter, for det ble ikke for mye. Det var veldig konkret hva vi skulle gjøre og det var bra.
Student 2: Og så likte jeg opplesingen i videoene. Han snakker veldig tydelig. Og hvis man vil ta opp hastigheten, så funker det kjempebra også. Så det er god hastighet.
Student 3: Han var flink til å vise hvilke knapper han mente, og så man skjønner hva det gjelder, det han snakker om.
Student 2: Saken er jo at man må lære seg alle navnene, hva alt er for noe. Selv om man følte veldig godt med, og så på quizen, det var litt sånn `hva var det igjen? ´. Så det er en puggingssak, tror jeg, fortsatt nå i starten.
KK: Hadde det vært bedre å dele opp kurset mer, eller kjøre øvingen i to deler?
Student 2: Da føler jeg det blir for lite å gjøre, hvis du bare skal ta den ene maskinen, for det var ikke så mange ting.
Student 4: Det er jo holdt for den ene, og har det bare en. Men det går jo an å gjøre det flere ganger, men nå skal vi jo vel gjøre det flere ganger senere uansett.
Student 2: Så jeg tror ikke du trenger å dele det mer.
Student 3: Men det var fint at du (the teacher/guide) var tilgjengelig, sånn at man kunne spørre om det var noe man ville vite, og ikke stoppet helt opp for at man ikke kom videre, for man visste ikke hva man skulle gjøre.

Student 1: Så måtte vi jo finne ut av det også. Vi måtte jo prøve ut ting, så det var jo fint. Så sånn sett er det jo bra på slutten, i hvert fall, når man har mestret det.
KK: Hvordan var det for dere den 360-funksjonen, at dere kunne snu rundt bildene og kikke på lokalen?
Student 4: Det var jo veldig greit, for ellers hadde jeg ikke visst hvor jeg skulle plugge mikrofonen.
Student 3: Det var fint.
Student 2: Det var veldig smart.
Student 4: Å begynne der først, og bare bli kjent med rommene. For det gjorde du i videoene. Du ikke trengte å lette, det var veldig godt forklart for alle tingene. For det gikk jo veldig raskt når vi så det.
KK: Er det noe som vi kunne ta med oss for å forbedre oss? Noe som vi kunne ha gjort forskjellig her i studioet eller på det digitale verktøyet?
Student 1: Jeg vet ikke, det er vanskelig, for jeg var egentlig fornøyd med alt som jeg har gjort. Så var jeg fornøyd med det og de videoene. Så vet ikke hva jeg skal rette. Det eneste er at kanskje videoene har en tittel på dem. For jeg kunne vel ikke se hva som var hva. Men det gjør jo at folk må bare ser de.
Student 3: Jeg har ikke vært i forelesninger enda, så jeg vet jo ikke på noen måte hvor mye teori dere har hatt i forkant av dette praktiske kurset.

G7 - Group 7

Date: 07.09.22
Number of participants: 3

KK: Hvordan opplevde dere løsningen i studio? Fra A til Å, fra oppgaven med mikrofonen og stativet til å sende lyd via forsterkerne osv? Var det forståelig nok eller var det komplisert? Hvordan føltes det i dag?
Student 1: Jeg synes det var veldig bra. Oversiktlig og ryddig.
KK: Var det noen områder som var ikke helt oppklart med tanke på oppgavene? Vi jobbet med gain-delen, vi jobbet med kompresjon. Og så sette opp lydspor i opptaksprogrammene. Var det noe som fungerte bedre enn andre deler?
Student 1: Nei, ikke som jeg kan tenke meg. For min del var alt veldig forståelig egentlig.
KK: De videoene som dere måtte se på, kunne vi ha gjort noe annerledes?
Student 2: Videoene var greie, men det var jo mer at du måtte kunne se det utstyret før du kunne gjøre noe med det. Det var litt vanskelig å huske på alt du skulle se i videoen og alt det der i studioet.
KK: Hva synes dere?
Student 3: Det er jeg litt enig i. Hvis man ser videoen i time i forveien, eller alle tre videoene, eller alle videoene generelt sett, så glemmer du på en måte litt ting før du faktisk kommer inn i det.
KK: Hva med å justere oppgavene her, eller at studenter tar innføringsressursen digitalt mens de er i studioet?

Student 1: Kanskje, ja, hvis vi hadde gjort videoene sammen, så hadde man kanskje fått et mer friskt innhold til å si. Hvis vi tre hadde sett samme video mens vi satt her, så kanskje hadde vi husket det bedre.
KK: Den 360-funksjonen på kurset, hvor man kunne snu bildene rundt og kikke, hva synes dere om det?
Student 2: Det var en komplisert måte å gjøre det på, det hadde vært lettere å bare ha en video, rett og slett.
KK: Kunne du si litt mer om det?
Student 2: Det var ikke det beste bildet. Jeg synes at de 360-bildene kunne ha vært litt bedre.
KK: I begge rom?
Student 2: Det funket på lydstudiorommet, men på det andre rommet (kontrollrommet) det var ikke veldig mye å se.
Student 3: Det var litt bedre på lydstudioet. Det var litt lettere å se forskjellige ting også. For på lydstudiorommet så følte jeg at hvis du hadde bare fått bilder av tingene, så hadde du ikke fått noe særlig begrep på hvor de var i forhold til hverandre. Men så du kunne se hele rommet, eller se bilder av det, og så trykke på tingene, så fikk du jo et bedre inntrykk av hvor ting var i forhold til de andre tingene.
KK: Hvordan opplevde dere quizene? Hvordan var det mengden av videoinnhold som man måtte se i forkant av en quiz?
Student 2: Jeg tror det hadde vært bedre hvis du hadde delt opp litt mer. Da du fikk for eksempel en video, og så fikk du etterpå en quiz om det som var i videoen, i stedet for å se tre-fire videoer. Så du får et spørsmål med en gang om det du nettopp har sett, og så svarer du på det, da får du det litt mer forsterket.
Student 3: Jeg er enig med det.
KK: Noen andre tanker eller forbedringsforslag? Enter her i studioet eller på den digitale ressursen.
Student 1: Nei, annet enn det var det helt greit.

G8 - Group 8

Date: 08.09.2022
Number of participants: 4

KK: Kunne vi diskutere litt om hvordan dere opplevde dagens øving, hva gikk greit, hva ikke gikk greit osv.
Student 1: Jeg synes det var gøy!
Student 2: Det var gøy.
KK: Var det? Hva var gøy?
Student 1: At jeg bare satte opp alt fra starten, selv om jeg ikke visste så mye om lydstudioet. Sånn å jobbe med knappene. Jeg synes det var gøy å lære det og se hvordan det funker.
KK: Kunne du tenke deg at dere kunne jobbe her på samme måte uten en teknikker i nærheten? Hvis du hadde kun det digitale verktøyet som referanse, de videoene?
Student 1: Nei
KK: Hvorfor det?

Student 1: Det var noen små ting som ikke var med i videoen.
Student 2: Og så gikk det veldig fort. Det var liksom kjapt gjennom alt mulig. Man trenger å ta det litt rolig.
Student 3: Jeg tror det hadde gått hvis vi hadde begynt å se videoene nå på nytt mens vi holdt på, kanskje. Men det var veldig greit å ha noen som kunne spørre om hjelp underveis. Hvis det var noe vi kanskje ikke helt skjønte, for eksempel.
Student 1: Ja. Det er sant.
KK: Noen andre?
Student 4: Første gangen er det jo gøy at jeg har bistand uansett, synes jeg. Digitalt er ikke så gøy alltid. Det er lettere å få hjelp fysisk enn digitalt.
KK: Med tanke på å beholde informasjon langsiktig, er den en måte bedre enn den andre eller ikke? Hva synes dere?
Student 4: Fysisk, egentlig. For det kan jo spørre litt mer, gå enda dypere inn i.
Student1: Husker man det bedre hvis man gjør det fysisk med en person, enn å se det på nett.
Student 2: For det går jo på muskelminnet. At man husker hvor man har vært, og hva man gjør. Det kan man ikke gjøre på digitalt.
Student 3: Jeg synes det digitale var veldig greit. Det var litt kult at man kunne snu rundt i rommet og se. Jeg synes det funket bra det også. Det er kjekt å ha en digital visning når man ikke har kjempelang tid med en lærer.
Student 1: Jeg synes det digitale funket. Gjennom at man fikk se rommet, så fort jeg kom inn, så var det sånn «å ja, der husker jeg mikrofonen lå», så vi slipper å lete. Det var veldig greit.
Student 2: Du så fargen på de ulike boksene lettere.
Student 1: Vi visste hvor det meste lå, og hvordan det vi skulle bruke så ut. Det synes jeg funket.
KK: Hvordan gikk det med avspillingskvaliteten fra videoene?
Student 1: Ting hakket der av of til.
Student 2: Ja
Student 3: Stemmer, av og til inne det 3D-rommet.
KK: Noen forbedringsforslag?
Student 4: Det funket egentlig. Det er veldig fint å se det litt først på digitalt, og så få hjelp.
Student 3: Så lenge det er en kombinasjon, så funker det bra.
Student 2: Jeg synes det funket bra med kombinasjon også. Var det også greit at dere gjorde de delene til en innlevering, slik at man var sikker på at man fikk gjort det først.

G9 - Group 9

Date: 13.09.22
Number of participants: 3

KK: Kunne vi snakke litt om deres opplevelse i studioet i dag? Hvordan fungerte for dere?
Student 1: Det var greit egentlig.
Student 2: Jeg synes det var veldig greit. Vi lærte veldig mye av å se på de videoene før vi kom. Hvis vi ikke hadde kunnet sett på dem, da hadde jeg bare stått her og ikke skjønt noe.

Student 3: Det jeg synes var best var at vi satt oss inn i det selv. At vi gjorde det selv. Og så var du der så kunne vi spørre deg. Sånn at vi var sikre på at det fungerte.
KK: Kunne det ha fungert uten en teknikker i nærheten?
Student 3: Nei, absolutt ikke.
Student 2: Men det handler om at på det arket (the sheet with the studio tasks) så er det jo så mange begreper av ting vi ikke har hørt om.
Student 1: Det er litt vanskelig.
Student 2: Jeg har ikke vært på mange forelesninger.
Student 1: Når vi startet så skjønte jeg ingenting. Nå skjønner jeg jo det meste når vi har gått gjennom det. Men jeg skjønte ingenting når vi bare skulle gjøre det selv.
KK: Husker dere noen spesielle begreper som var vanskelige?
Student 3: Det er bare alt som har med lydstudio å gjøre.
Student 2: Alt er nytt.
Student 3: Vi hører jo ikke om dem før vi ser videoene.
KK: Kunne dere ha tenkt om å gjøre dette på en annen måte?
Student 2: Jeg tror at hvis man kan se på videoene mens man er der inne kanskje. Det hadde hjulpet veldig mye tror jeg.
Student 3: Eller så må det bare ha bilder av de forskjellige tingene på baksida av arket.
Student 2: Ja kanskje.
Student 3: Men jeg synes det var greit å kunne se på videoene.
Student 2: Ja, hvis du gir oss det arket nå så forstår vi jo hva du gjør.
Student 1: Det er veldig individuelt at noen vil gå inn der i dag og ta det veldig lett.
Student 2: Men jeg synes det er veldig mye. Jeg følte nesten at jeg måtte pugge. Jeg satt og måtte lese på ting flere ganger i går.
KK: Det digitale kurset, hvordan opplevdes det?
Student 3: Det var egentlig ganske greit.
Student 2: Det var greit, ja.
KK: Det med at dere kunne skikke litt rundt på lydstudioet med den 360-funksjonen?
Student 1: Det gjorde jeg egentlig ikke så mye, for å være helt ærlig.
Student 2: Jeg gjorde litt. Men det er annerledes enn å faktisk være her.
Student 3: Jeg synes ikke det hjalp så mye egentlig.
Student 1: Nei, for jeg klarer ikke helt å se hvor jeg er i forholdt til romorienteringen. Den skjer ikke før jeg går inn i rommet.
KK: Hva med det 360-bildet fra kontrollrommet?
Student 2: Det hjalp, det var bra. For da visste vi akkurat hvor vi skulle jobbe.
Student 1: Og hvilke lamper som ikke lyste, og hvilke som lyste.
Student 2: Det også.
KK: Hvis vi må endre noe, hva kunne vi gjøre bedre til neste gang?
Student 3: I teorien trenger man ikke å endre så mye annet enn at man bare må tenke på den oppgaven som en person som ikke kan noen ting. For det er så enkelt når du kan det, når du vet hva som er i quizen. Så kan det der virke skikkelig enkelt. Men for oss som ikke kan noen ting, så blir det litt gresk.
Student 2: Kurset var litt avansert, men så fort vi fikk se videoene igjen, og eventuelt spørre deg, så gikk det jo.

Student 3: Enig.
Student 1: Jeg synes faktisk at videoene var veldig bra. Det eneste som jeg tror hadde gjort at vi faktisk hadde klart det her helt alene i dag, er at vi kanskje i går kunne bare ha sett lydstudioet. Bare sett at det er der, og prøvde å trykke litt på knapper. Da tror jeg at det hadde gått veldig fint. Men ellers synes jeg alle videoene er veldig bra.
Student 2: Ja, de forklarer.
Student 1: Dere (the teachers) forklarer og sier hva ting er og hva de brukes til. Så jeg synes at videoene er bra.
KK: Mener du at det kan hjelpe med å slappe av hvis man ser lokalen i forkant av øvingen?
Student 1: Ja, fordi den romorienteringen får du ikke før du går inn i rommet.
KK: Hva var første inntrykk da dere gikk inn i rommet i dag?
Student 1: Det var overveldende. For når vi kom i dag var alt bare nytt, og så var det sånn at ting lå der og der.
Student 3: Jeg er veldig enig med begge to. Ellers synes jeg at det var bra og veldig gøy.
Student 2: Ja. Det var også veldig betryggende å ha en teknisk person til stede.
Student 3: Den feilen jeg gjorde med at jeg bare tok ut ledningen. Det sa dere i videoen, at det (on the preamplifier) skal være på `mute´. Men jeg glemte det jo. Så hvis jeg hadde gjort det hele tiden, og du ikke hadde sagt ifra, så hadde jeg kanskje ødelagt noe. Det er noen små detaljer.
Student 1: Ja, det er bare at det er så mye på den videoen.
Student 2: Det er mye, ja.
Student 1: Det er mye informasjon, selv om det skal være enkelt å forstå. Hvis jeg ser en video nå, så skjønner jeg jo alt. Men det er jo fordi nå sitter jeg med den feilen. Nå har vi vært der.

G10 - Group 10

Date: 13.09.22
Number of participants: 2

KK: Hvordan opplevde dere øvingen i dag? Var den fysiske løsningen brukervennlig eller komplisert? Kunne noe hatt blitt gjort annerledes? Hvordan gikk det for dere?
Student 1: Jeg synes det var veldig greit når vi hadde sett videoene. Men uten videoene så hadde jeg ikke ante hva jeg skulle begynne med. Du er litt redd for at det er kostbare ting og du har ikke lyst til å gjøre noe feil eller ødelegge. Så nyttig med video i forkant.
Student 2: Og så var det bra at du ikke hjalp oss så mye i dag. For da fikk vi utforske litt selv og prøve oss fram.
Student 1: Og så husker hjernen bedre hvis du har tenkt igjen. Hvis ikke noen bare sier ¨trykk på den¨.
Student 2: Du finner ut selv. Og så måtte vi samarbeide skikkelig, og det synes jeg var hyggelig.
Student 1: Og så at vi bare var to, også veldig bra.
Student 2: Det var veldig bra at vi bare var to.

Student 1: For vi fikk så mye tid til å gjøre det. Så han kunne gjøre det, jeg kunne gjøre det, vi kunne gjøre det en gang til. Og da lærer man å huske bedre.
KK: Hva om det var flere eller fire i gruppen?
Student 2: Da tror jeg det er to måter å sette på. To gjør det, så måtte bytte. Det er alltid mye venting og sånt.
Student 1: Du får jo gjøre mindre når det er flere som skal dele på det. Så det var veldig fint å være to. Det var veldig gøy. Vi lærte mye. Vi hadde aldri vært inne eller sett før til å skjønne hva som hørte sammen.
KK: Hva med det digitale opplæringsverktøyet i Canvas? For eksempel den 360-funksjonen hvor man kunne snu bildene og kikke rundt.
Student 1: Vi fikk jo lært hvor ting lå. Vi visste at mikrofonen lå i skapet, for det har vi sett i videoen.
Student 2: Det var egentlig bare på den første delen (the sound studio) vi brukte 360. På den andre (control room) brukte ikke det. Det var sånn jeg gikk inn i studioet og tenkte ¨her har jeg sett før¨. Så jeg hadde litt oversikt, så det funket bra.
Student 1: Kombinasjonen var egentlig bra, for jeg hadde fersk den første videoen, mens du (student 2) hadde sett den i går.
Student 2: Det var veldig bra.
Student 1: Og så var det greit at du visste at det ikke var denne videoen, det var neste.
Student 2: Ja, jeg visste det.
KK: Var det noen seksjoner som dere opplevde utfordrende i dag?
Student 2: Det var små detaljer som jeg ikke hadde fått med. Hvordan man skrur på høyttalere, det hadde jeg glemt. Hvordan man skrur på de forskjellige maskinene. Det var sånne på-knapper.
KK: Noe annet som dere kan tenke på?
Student 2: Nei, jeg synes det var veldig bra.
Student 1: Veldig gøy. Jeg hadde aldri trodd at jeg skulle synes at lyd var så gøy. For det tenker på at det bare er lyd, men nå tenker jeg sånn, ¨å, nå gleder jeg meg til vi skal lage podcast¨
KK: Hva var det som var gøy?
Student 1: Å få til hele pakka. Og når vi hørte på vårt opptak på slutten, så hørtes det jo profesjonell ut. Så tenkte jeg, ¨wow, det her har vi gjort¨.
Student 2: Det var kanskje en mestringsfølelse. Det var skikkelig digg.

G11 - Group 11

Date: 13.09.22
Number of participants: 3

KK: Hvordan opplevde dere dagens øving?
Student 1: Jeg tror jeg bare trenger mer tid. Du skulle ha hatt mer tid til å gå gjennom alt, egentlig. Sånn som du sa før, at de fleste ikke gikk gjennom kompresjonsdelen alene. Det er jo ganske vesentlig, så du slipper mye arbeid senere.

KK: Hva med å ta den digitale ressursen her i studio samtidig som man jobber med oppgavene?
Student 2: Jeg likte å ha videoene, og se på de i går. Fordi da visste jeg litt hva det var jeg kom til, og jeg var ikke helt `clueless´. Men da hadde jeg sikkert hatt greit å jobbe med det her også.
Student 3: Ja, jeg er enig. Det var fint å se det digitalt først, før du kom inn i selve studio for å jobbe og lære. Så det å ta digital læring på Canvas, det var veldig greit.
KK: Hvordan fungerte for dere kurset på Canvas?
Student 1: Jeg kom nær en knapp på den ene, så forsvant jo alt. Og så røyker jo hele greia. Så fikk jeg jo null poeng på nummer to, tror jeg.
KK: På del 2?
Student 1: Og så del 3 har jeg bomma på ett på første, ett på siste. Jeg synes det var litt kronglete.
KK: Hvordan fungerte dette med din læringsprosess?
Student 1: Først så jeg alle videoene, og så stod det at jeg skulle ta en quiz, men skjønte jeg ikke hvor den var. Så trykket jeg på noe, men så skjedde det ikke noe. Men, det var min feil.
KK: Jeg tror ikke det, det var også andre som rapporterte tekniske problemer med integrasjonen i Canvas. Hvis vi kunne korrigere eller forbedre noen ting?
Student 3: Nei, som opplevelsen min var, så funket det veldig greit. Men det kan være at det ikke funker like greit for andre.
Student 1: Nei, mer tid kanskje bare. Men det er jo noe som kommer etter hvert, om vi får jobbe litt mer med det.
KK: Mener du å få mer tid i øving?
Student 1: Ja, mer tid på alt egentlig, så vi får gå skikkelig gjennom det.
KK: Hvordan var det for å ha del 1 av kurset med en video, og del 2 med fire videoer?
Student 2: Jeg synes det fungerte greit, egentlig.
Student 1: Prosessen var at vi skulle gå gjennom de læringsressursene i forkant, og så skal vi komme hit, og så skal vi gjøre alt selv. Hvis ikke du hadde vært her (han mener læreren), så hadde det vært håpløst. Du må ha en som kan det, som kan vise deg det, som kan lære deg det. Ikke bare, utelukkende gjøre det selv.
Student 2: Det er sant.
KK: Hvis dere hadde la oss si tre timer, eller fire timer på laben, hadde det funket uten en teknikker til stede?
Student 1: Er usikker.
Student 3: Hvis man får øvd nok, så går det jo fint. Men sånn som i dag, så klarte vi det ikke helt, før du kom inn og ga oss mer informasjon. Men hvis vi kan få god tid i studioet på skolen, når det ikke er noe oppgave, så kan det være at vi får bedre kontroll på de ulike tingene etter hvert. Sånn at vi kan være her, alene.

G12 - Group 13

Date: 14.09.22
Number of participants: 4

KK: Kunne vi snakke litt om hvordan dere opplevde lydstudioet i dag? Med tanke på koblinger, enheter, hele opplevelsen fra A til Å.
Student 1: Jeg synes det var ganske greit. De læringsressursene vi fikk, de har jo hjulpet veldig godt med å forberede oss.
Student 2: Jeg synes det var veldig greit, i hvert fall som du sa med de videoene vi fikk se på først. Da var det ikke helt ukjent når vi kom hit. Da hadde vi fått se det og visste hvordan det funket. Og at vi kunne gå tilbake til dem når vi var usikre.
KK: Hva om dere hadde jobbet her uten en teknisk person i nærheten?
Student 1: Jeg tror det hadde gått fint uten.
Student 2: Det hjalp litt at du (the teacher/guide) var her.
Student 1: Jeg tror vi kunne ha klart det med de videoene vi fikk og finne ut av det.
Student 3: Vi kan bare sette det opp nå, men det er jo med sånn fin justering som vi må se litt mer på kanskje.
KK: Var to timer nok til denne labøvingen?
Student 1: Ja
Student 4: Det virket veldig greit. Vi ble jo ferdig egentlig nesten akkurat på to timer med oppgavene.
Student 3: Vi fikk jo gått gjennom oppgavene.
Student 4: For oss så passet det helt perfekt.
Student 3: Vi fikk leke også litt med utstyret på slutten.
KK: Hvordan fungerte den digitale ressursen for dere?
Student 2: Det funket bra for meg.
Student 1: Ja, med meg også.
KK: Hva med den 360-funksjonen hvor man kunne snu rundt bildene fra lokalen og kikke?
Student 3: Det hjalp egentlig litt med å vite hvor alle tingene lå. Der henger kablene, der er mikrofonene, der er hodetelefonene, der skal du plugge inn. Det hjalp å orientere seg litt i rommet.
KK: Noen forbedringsforslag, enten her i studioet eller på Canvas?
Student 3: Videoene var jo greie nok til at vi visste hva vi skulle gjøre.
Student 4: Jeg vet ikke om det er litt `nerdy´, men hos meg var det sånn at vinduet var veldig smalt.
Student 1: Det var veldig lavt.
Student 4: Jeg synes det kunne ha vært fint å ha det i full skjerm. Vi var begrenset med vinduet.
Student 2: Jeg er enig. Jeg tenkte også det hadde vært fint å ha det i full skjerm.
Student 4: Videoene var små i 3D-rommet.

G13 - Group 15

Date: 25.10.22
Number of participants: 4

KK: Du nevnte at dere hadde tekniske problemer med innføringskurset?

Student 1: Ja, vi hadde problemer med quizen da det handlet om å ta et nytt forsøk. Det var noen problemer med feil registrering av forsøk.
Student 2: Jeg hadde samme problem. Jeg kunne ikke ta quizen igjen, systemet trodde at jeg hadde tatt alle tre forsøk.
KK: Hvordan gikk det med å spille av videoene?
Student 1: Jeg så på mobilen. Hvis du så på PC, så funket det sikkert mye bedre. Men på mobilen, så måtte jeg holde inne for å åpne opp den. Men i begynnelsen, så trykket jeg bare, så hørte jeg lyden, men den kom ikke opp i 3D-modulen i det hele tatt. Så jeg måtte holde inne for at den skulle åpne opp i 3D-modulen på mobilen. Men på PC er det sikkert mye lettere.
Student 2: Det var tregt på PC også, det hakket. Det tok tid før videoen spilte av. Og så fikk jeg heller ikke tatt den om igjen. I første omgang kunne man prøve den igjen, men jeg kunne ikke prøve igjen.
KK: Hvis vi kunne gå tilbake og designe kurset på nytt, hva kunne vi ha gjørt annerledes?
Student 1: Hvis vi hadde quizene i egne quizmoduler, i stedet for inne i 3D-rommet så hadde det vært fint. Jeg trodde det var noe problem med måten det var satt opp i systemet.
Student 3: Jeg hadde ikke noen problemer med det.
KK: Hvordan opplevde dere den 360-funksjonen?
Student 4: Det hjalp når det kommer til hvor tingene er i studio. For å vite hvor nært våre ting lå.
Student 2: Inni studio synes jeg det var greit med 3D. For da skjønner jeg hvilken video er knyttet til hvilken ting. Der synes jeg det er mye lettere for meg, der er det den vi skal se på, og så der er det den. Så jeg visste hvordan den fungerer.
Student 1: Ja, den blir visuelt å se Portico-ampen i stedet for å bare høre om det.
Student 2: Det er bra å dele opp verktøyene i forskjellige seksjoner, i stedet for alt i ett.
Student 1: Ja, for jeg tror du kunne ikke ha oppnådd det samme med bare bilder av de forskjellige tingene.
Student 2: Kanskje du hadde fokusert mer på interaktive videoer, der det kommer pop-ups, og så zoomer man inn, og så får man se knappene, og så videre på en måte. Og heller sette mer energi i selve videoen.
Student 1: For meg så lenge videoen funker så er jeg fornøyd, for der får jeg se hva vi egentlig trenger å lære. Quizer er egentlig bare for å sjekke om vi egentlig har lært noe, fra å se på video. Det er det jeg har tenkt.
KK: Noen andre forbedringsforslag?
Student 3: Jeg synes ellers funker det fint.
Student 1: Ja
Student 2: Det er greit, jeg synes du lærte oss normen med å bare gjøre det. Det er veldig greit, sånn at vi ikke ødelegger noe. Med en slags liste, at den ene skal skrus opp først, og den andre skal skrus opp sist og så videre.
KK: Kunne dere ha tenkt å jobbe alene uten en tekniker i nærheten?
Student 2: Jeg føler meg komfortabel nå, etter i dag. Og nå har du lært meg at jeg skal være veldig forsiktig med utstyret, og nå kan jeg huske hva du sa, så jeg må ikke gjøre det og det.
Student 1: Det kan være at det går litt tregt i første dagene, men man blir vant til det ganske fort siden vi vet prosessen nå.

G14 - Group 17

Date: 25.10.22
Number of participants: 3

KK: Kan vi snakke litt om dagens øving, hvordan opplevde dere det og lokalen?
Student 1: Jeg synes det hjalp å ha en som visste alt, hvordan du gjør det og fasiten på alt. Og visste om ting var riktig eller hvorfor utstyret ikke funket, eller om vi hadde gjort noe feil.
Student 2: Det hadde nok tatt veldig mye lenger tid hvis vi skulle stått her og vært alene. Da måtte vi bruke YouTube og finne ut mye og søke opp, og da hadde vi vært her lenger. Så var det nyttig å ha deg som kom her og ga noen tips.
KK: Hva er fordelen med en teknikker til stede selv om det finnes en nettbasert ressurs?
Student 2: Det var litt betryggende at du var her. Det var litt sånn, ¨ja, det kommer til å gå bra¨ hvis vi trenger hjelp, dette får vi til.
Student 3: Det er litt skummelt alt sammen da, det er overveldende. Mye dyrt utstyr. Du er redd for å gjøre noe feil, trykke på noe feil, du tør nesten ikke gå med.
KK: Hvordan opplevde dere den 360-funksjonen?
Student 3: Det var litt tungvint, men det syntes jeg var greit. Det var bra laget.
Student 1: Jeg likte quizen og videoene, det var bedre enn de andre quizene der det bare er spørsmål, og så har du ingen guide til hvor du finner svaret.
Student 2: Det hadde vært kult hvis de quizene også hadde hatt litt mer video, kanskje. For det er litt vanskelig å søke på alt.
KK: Det er noen forbedringsforslag. Hva om studentene tok nettkurset på samme tid som de møtte opp i studioet?
Student 1: Nei, jeg synes det hjelper å ta kurset først, for da var jeg forberedt og ikke kom blindt inn i studioet. Føltes som jeg kunne litt da jeg kom inn, for jeg hadde jo sett på 360-ressursen og svart på quizene. Jeg synes det var effektivt.