EDUFADE

A Digital In-action Peer Feedback System To Enhance Student Involvement During Musical Microteaching Sessions

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Abstract

Primary school teachers often do not feel properly prepared to teach musical classes when they graduate from the teachers' college for primary education. This lack of preparedness is mostly caused by a shortage of time allocated to music classes during their education. To optimize the limited time peer feedback during microteaching sessions is identified as a valuable learning opportunity. In this thesis, a digital in-action peer feedback system called EduFade is proposed, designed, developed, and tested using an iterative approach, where multiple experiments were used to identify problems and possible improvements. During this process, it was discovered that students lack time to read all feedback during a microteaching session. Educators were tasked with filtering the most important feedback. This filtered feedback would only be sent to the presenting student to avoid cognitive overload. Feedback criteria offer a structured approach for students to give feedback, and it is difficult for students to give feedback during an active microteaching session. Research for the implementation of this tool will continue in the future, improving it and hopefully bringing it to school classes across the world, improving musical education.

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Terminology

Vicarious learning: The effect of people learning from each other's experiences.
Microteaching: A method of teacher-teacher training where one student takes on the role of a teacher, and the other students participate as if they are in a real classroom setting. This is done to simulate a classroom setting for the students to practice in.
formative feedback: Feedback that is given during a process, so that it can be implemented.
Summative feedback: Feedback that is given after a process is finished, intended for reflection upon the process.
Whisper: A message sent by the educator to the presenting student during a microteaching.
Custom whisper: A personalized whisper typed by the educator
PABO: The Dutch teachers' college for primary education

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Introduction & Background

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Disclaimer: Chapters 1 and 2 are almost entirely copied from a previous document handed in by Midas Minnegal called "Enhancing primary school teachers' confidence and performance in teaching music classes through improvement of teachers' college for primary education using interaction technology". All other chapters might also include small parts copied from this document.

1. Introduction

Music is an important subject for children. According to Lei et al. (2015), musical education has multiple benefits for a child's development. Children who receive qualitative music education, are more sensitive to musical impulses, move well on music, sing more, are more likely to join a band, and are more able to actively participate in the musical culture. Lei et al. (2015) argue that music stimulates certain brain functions. The brain benefits from being challenged on multiple fronts. According to them, there are 'confusing' fronts for the brain, like mathematics and language, and less 'confusing' fronts of which music is one. Negative school results might follow due to a limitation of stimuli in different areas when the brain only receives challenges in 'confusing' environments. Scherder (n.d.), found that active involvement (including listening to music, moving to music, and making music) activates and stimulates the development of the neural networks in the brain. People who are exposed to music from a young age are better at making connections, planning, mathematics, and languages. Participation in music can have a positive effect on human health. Mieras (2021) mentioned in an interview that adults who attend concerts have a reduced likelihood of visiting the doctor, experiencing fear, or feeling depressed. Additionally, music can serve therapeutic purposes, including the treatment of Alzheimer's, Parkinson's, Tourette's, and other neurodegenerative and motor-impaired conditions, as suggested by Sacks (2006).

To investigate the impact music has on children at the primary school, and to identify possible problems in the music education that they had received, two Dutch primary school teachers were interviewed. One interviewee is an experienced teacher who has been in the profession for 24 years (Appendix A). The other interviewee just started teaching at the primary school a couple of months before the interview took place, which is the Dutch teachers' college for primary education according to bab.la (n.d.). She was still in education at the PABO when the interview took place. During this thesis, music educators at PABOs in the Netherlands were interviewed for research purposes which highlighted some possible issues with music education (Appendix E, H).

An interviewed primary school teacher (Appendix B) mentions that music is a source of joy for the children in her class. She noticed a visible increase in children's happiness after a music class, improving their listening abilities, and having a positive effect on how they feel and out themselves. Another interviewed primary school teacher (Appendix A) mentions that when a child is not good at subjects like mathematics, or language, they can still "shine" in the classroom during the music subject. This enjoyment of music is backed up by parents telling teachers how much their children enjoy music classes according to De Vries (2015).

Even though the importance of music is known, primary school teachers are ill-prepared to effectively teach music as part of their daily classroom practice when they graduate, leading to the subordination of the course at primary schools. The negative effects of this decline in primary musical education are already seen in the field. A music educator at a PABO mentions in an interview (Appendix E) that a noticeable decline in musical skill levels is visible for new students throughout the years. An interviewee who teaches at a primary school (Appendix A) points out that colleagues who do not have a musical background, like playing an instrument, often have trouble teaching musical classes at her

primary school. They dislike teaching these classes and they often do not go any further than singing a song with the children. She stated that the musical lessons she had at the teachers' college for primary education, which is called the PABO in the Netherlands, were not noteworthy.

According to an interviewee (Appendix B), music is taught bi-weekly for two modules at the PABO. Because the classes are taught bi-weekly, only one module gets effectively spent on music which is not enough to raise the musical confidence of a student who lacks a musical background. A teacher at a PABO mentions in an interview (Appendix E) that there are specializations available for extra-musical education at the PABO. These courses are often only picked by students who have an interest in music, and a musical background. This lack of musical background, paired with a general lack of confidence in musical teaching abilities, leads primary school teachers to often neglect, or even skip the music lessons.

Dedicating more time to teaching music at the PABO would be an ideal solution, but this will cannibalize the teaching of other subjects due to limited time in education, making it not feasible. Instead, this thesis will focus on improving elements of these musical classes to use the limited time more optimally. In a previous study by Minnegal (2023), the feedback process was identified as a promising potential enhancement for these music classes. McPherson et al. (2022) argue that feedback is one of the more significant influences available in education to improve performance, making it a viable mechanism to enhance learning in general. Vollmeyer & Rheinberg (2005) found that even the premise of receiving feedback led students to employ better strategies from the start, and gathered significantly more knowledge.

A digital solution was identified as promising to enhance this feedback process. When using a digital system, feedback can be stored in the cloud and made available anywhere, at any time. Feedback can be sent at a moment of choosing, and a digital system can display feedback in various ways, enhancing the analyzing experience for students. Students already have phones and laptops available during class sessions, meaning that no major alterations to class setup are required.

In this thesis, a digital tool was constructed which provides a feedback methodology with a central role for interaction technology. The tool supports the educator in the feedback process of a PABO music class by requiring them to think about criteria that feedback should be given on and making feedback more easily insightful. By implementing in-action feedback the feedback receiver can immediately implement the received feedback in their activities, whilst the provider of feedback is challenged to more actively reflect on the work of the feedback receiving student. The tool should give more structure to the feedback process, and should not be a major disturbance of the music classes. To design such a tool, the context of musical classes was researched, and situations where feedback can be beneficial were identified. Different methods of feedback were investigated, and this led to a proposal for the design of a digital feedback system, together with a philosophy on how to give feedback properly in a music class. This system is developed and tested thoroughly in different real-life scenarios. After each test, conclusions were drawn leading to improvements in the system.

The research was conducted on PABOs, as well as on conservatories where music didactics are taught. The thesis reaches beyond the PABO because conservatories and PABOs share the common goal of teaching students how to teach music. This is why the inclusion of conservatories enriches the data collected, instead of distorting it. This research is expected to apply to these conservatories, as well as to other teachers' colleges for primary education beyond the PABO.

2. Background

Before designing an interaction technology-driven feedback framework, background research was conducted. In this chapter different ways of providing feedback were looked into, as well as different aspects of effective feedback. additionally, the context of a musical class was researched to highlight lesson components that can benefit from feedback. Finally, implications found in another study of a digital system for in-class peer feedback were highlighted.

2.1. What is feedback

TThomas & Arnold (2011) argue that feedback is a description of what is observed, not a judgment of work or a person. Feedback is formative and designed to improve future performance. Feedback differs from assessment in that assessment is summative and designed to evaluate past performance. There is not one static algorithm for giving feedback, because it is context and learner-specific. This of course is only one way of thinking about feedback.

Thomas & Arnold (2011) argue that Feedback can be given in two ways. Firstly, it can address areas where the learner is already at a high level to further enhance this level. This will increase the awareness of the learner's possible areas of improvement. Secondly, it can help to bridge a gap between the knowledge of the learner and the expected level. With this approach, the person who is providing the feedback can collaborate and construct a plan with the learner to improve performance.

There are many different methods of giving feedback. However, they are not all created equal. A common method is through assessment. According to Liu & Carless (2006), there is a difference between peer feedback and peer assessment. Peer assessment is more based on grading, and less suitable for learning. Peer feedback is often better received than peer assessment by the student who is being evaluated.

Hattie and Timperley (2007) argue the potential of well-structured feedback in educational settings. They advocate for a systematic approach to providing feedback that addresses task performance, processes, self-regulation, and self-belief, ensuring that feedback contributes to meaningful learning and improvement. They identified the following three different forms of feedback:

- **Feed-back** (How am I going?)
  This is information relative to a task. It updates a student on the progress of this task. The type of feedback is often related to previous performance. It is effective when it consists of information about progress, and how to proceed.
- **Feed forward** (Where to next?)
  The answer to this question is usually one or more new tasks or goals for a student, leading to more expectations of the student. The power of this type of feedback is to provide information that leads to greater possibilities for learning.
- **Feed up** (Where am I going?)
  Judgment for this might be direct, like the passing of an exam, but it can also be comparative, like

doing better than last time. Goals can promote an action towards where you are going. This type of feedback allows students to set new goals, and to know when a goal is reached.

2.2. Vicarious learning in feedback

Vicarious learning is the phenomenon of people learning from each other's experiences. It can be defined as "The medium of human imagination to allow one to learn through the experiences of another". There are multiple varieties of vicarious learning according to Roberts (2010): Being able to observe experts or peers, learning through the experience of another, through discussion with a more competent other, and from storytelling. Mayes (2015) mentions that vicarious learning can be enhanced if feedback is given publicly. This way peers can read the feedback given by a superior to other peers so that they can learn from each other's mistakes. This however comes with some concerns, of which privacy is a major one.

A downside of feedback is that it can be time-consuming for the educator to give. Peers can be tasked with giving feedback, which is called peer feedback. This is expected to not only lighten the load on the educator but also stimulate vicarious learning because it requires more active thinking about the experience and the thought process of the peer who is being reviewed.

Craig et al. (2006) have shown that deep-level-reasoning questions in educational content have a major positive impact on vicarious learning. Deep-level reasoning questions are questions that require learners to engage in higher-order thinking. An example of such a question is "Why do you think this principle applies in this situation?". This question challenges a student to think critically about the underlying principles and to make connections between the principle and the situation that is currently being discussed. This means that asking questions, especially deep-level-reasoning ones, pays off. Their experiment was conducted in computer-based courses, but it is expected that this result will transfer to other contexts as well.

Vicarious learning is interesting for this research since it allows the students to learn from each other. In particular, peer feedback is interesting, since not only the feedback receiving student is learning, but it also requires the feedback giver to closely observe the work of a peer, which might lead to additional learning. Peer feedback and vicarious learning overlap in a multitude of areas, but inherit their own qualities as well. An overview of these qualities is shown in Table 2.1. this thesis needs to supplement peer feedback with vicarious learning to enhance the learning process.

	Vicarious learning	Peer feedback
Challenges peers to observe each other	x	x
Initializes a cognitive process based on observed actions	x	x
Peers learn from each other	x	x
Motivates imitation of observed behavior	x	
Suggests improvements to the observed peer		x

Table 2.1. Important simularities and differences between Vicarious learning and peer feedback

2.3. Peer feedback

There is evidence that giving peer feedback enhances student learning since the students are more actively engaged in understanding the work of others according to Liu & Carless (2006). Patchan & Schunn (2015) back this claim up by denoting that giving peer feedback to other students challenges them to detect and diagnose problems, and to select appropriate solutions. They also mention that there is potential to receive more feedback at a higher pace from a large set of peers than that a more limited set of academics would be able to do. When feedback can be delivered at this high pace, peer feedback has the potential to become a central part of the learning process according to their research.

The giving of feedback is a learnable skill according to Thomas & Arnold (2011), which indicates that the quality of feedback has the potential to substantially improve when it is more integrated into the educational system. Livsey & Lavender-Stott (2015) conducted a study in the medical field where they measured the learning effect of giving peer feedback in small groups. Their results were positive, but they mentioned that various sources have already verified that providing feedback aids learning.

Roberts (2010) mentions that participating in a discussion after a story has been told, improves the quality and recall of the story. This is probably because the people who are discussing it are challenged to more actively participate in the story. This is expected to relate to giving feedback in a class setting as well. When providing feedback one has to think actively, and critically about the situation they are providing feedback on.

Peer feedback is appealing for this project because feedback is proven to be one of the most effective ways to enhance learning. By using peer feedback, the learnings are enhanced, while not increasing the educator's workload significantly.

2.4. Reliability of assessment by students

Incorrect peer feedback would be concerning since not all feedback is shared in a digital system, meaning that the discussion of feedback is left out. This missing discussion can act as a safety net to catch invalid feedback in the class. When invalid feedback is interpreted as valid by a student, it might lead to a decline in performance. This section investigates in what manner a safety net for validating the correctness of feedback is required.

Assessment and feedback are not the same, because assessment focuses on grading, whilst feedback focuses on learning opportunities. Feedback is subjective, so the correctness can not be accurately measured. The results of peer assessment can be measured and compared to that of professionals. For this section, we assume that when a peer can accurately assess their peers, they can provide accurate feedback since they see what could be improved in the work of their peers. This does not mean that the quality of feedback these students provide is high, it merely indicates that the points of improvement are accurate. When students can give accurate peer feedback, the same positive effects from receiving feedback can be expected from peer feedback, as from regular feedback.

Some educators dislike peer assessment because students might not be reliable in grading or

assessing their classmates according to Liu & Carless (2006). Social constructs might get in the way of fair grading. Students also have less expertise than academics, so their assessing capabilities might not be on par. Whenever peers do not have to award marks, the reliability of the grading will not be an issue, however, student motivation might be low when the feedback has no bearing on the final results of the assessed student. A useful way of motivating students to give proper feedback is by letting a percentage of their final grade be dependent on the quality of feedback they give. When students are involved in the generation of assessment criteria, they will be able to judge other students better. People who do peer assessments become better at self-assessments as well.

Li et al. (2016) found that agreement accuracy between educators and students in different studies varies when one is assessing another student. Some studies have found an agreement of only 29%, whilst others have found almost perfect agreements of 98%. Gracias & Garcia (2013) back this claim up by finding fluctuating results in varying studies about the agreement of students and educators when assessing.

A study by Gracias & Garcia (2013) had a too low sample size to show significant results, but they did show an apparent pattern, where peer assessments by students were consistently higher than the assessments given by the educators. There however was a clear correlation between the grades given by the educators and peers. This favor for higher grades given by peers might be caused by a lack of experience in assessing, or due to personal affinity with the person who is being assessed. We can conclude from this correlation that peers do see similar differences in quality as the educator.

According to Kulkarni et al. (2015), rubrics can be an efficient way to give accurate feedback. When giving online feedback via a rubric, an agreement between the reviewer and the person being reviewed was reached of 74% in an online class, and 93% in a physical class setting. After the experiment conducted by Gracias & Garcia (2013), peers gave feedback that having the assessment criteria via a rubric in advance helped with the assessment, and thus possibly enhanced the ability of the peers to assess. Implementing feedback, instead of assessment in the form of a rubric, is an interesting opportunity to possibly enhance the quality of feedback for this thesis.

2.5. The context of a music class

During this study, two teachers at a PABO were interviewed (Appendix A, B), together with six educators who teach music at PABOs or the conservatory (Appendix C, D, E, F, G, H). One of the goals of these interviews was to gather information about the context of music classes. This has highlighted opportunities for implementing peer feedback into music classes.

Music classes on the PABO consist of approximately 20 to 30 students. The first-year classes are often bigger than the second-year classes since some students drop out. Classes in the conservatory are smaller, ranging from 5 to 20 students. Lessons are flexible and might deviate from what was prepared by the educator since music lessons are unpredictable. This means that learning goals might have to be adjusted during a lesson. It is more important to finish one learning goal during a session, than it is to merely touch on all the learning goals which were intended for that session.

Music lessons consist of two main components, a theoretical component and a practical component. This theoretical component is often taught with PowerPoint presentations where an educator verbally gives information to their students. It is important for an educator to not talk for the entirety of the

lesson because students are more involved in the lessons when they are active. This is why this theoretical part of the lesson is often alternated with a practical, more active lesson activity. This practical component of the class can be taught with various methods, but the core of these methods is that they are often short and fun exercises for the students to conduct classically, or in small groups.

A method of teaching this practical component in music classes which was brought up multiple times by different educators during the interviews, is a simulation lesson, also known as microteaching. This is when one student prepares and teaches a lesson to their peers. The peers have to follow this lesson and act like they are the target audience the lesson is created for. This is optimal for the teaching student since they can practice teaching as if it were in a real classroom. This however is suboptimal for the peers following the class session, especially at institutes like the PABO, since this means that the peers are following a music lesson on primary school level. This setting does give possibilities for vicarious learning to occur through peer feedback since this can involve the peers more in the didactic side of the session by letting them reflect on the session through the giving of targeted feedback. This is why this type of session was identified as the most promising field to implement a peer feedback system during this thesis.

2.6. In class digital peer feedback systems

One digital in-class peer feedback system was found, which is used for giving feedback during presentations. Presentations are similar to microteaching since one student is in front of the class giving a demonstration to the other students. This system was created by Shannon et al. (2016) and is called Peer Presents. With Peer Presents, peers can give feedback based on a rubric created by the presenting students. All the peers can see the answers that are given in real time and can vote for the most relevant answers. When a presentation is done, the feedback is delivered to the presenting students.

This study points out that in-class feedback systems have the following design considerations, which are also important for the system designed in this thesis.

- **Time**
  There is a limited amount of time in a class session, and this time is valuable. Educators often have a time shortage, which was also mentioned by the interviewee in Appendix B.
- **Management logistics**
  A system should not put a burden on the educator. The peer feedback and rubrics that the feedback is given in might have to be checked by the educator.
- **Risks for students**
  Peer feedback requires the students to publish their work. This might lead to privacy concerns or even potential embarrassment. To avoid these risks, students might be reluctant to criticize their peers when providing feedback. This study shows that the majority of students might not be concerned about publishing their work since twelve out of fifteen students used their real name as a pseudonym.
- **Classroom culture**
  Peers need to trust each other. They might neglect feedback when they do not trust each other. There should also be a non-threatening collaborative atmosphere to avoid the defensive behavior of the people who are receiving feedback.

- **Attitude towards technology use**
  Instructors might have a different attitude towards technology in the class. Whilst some embrace it, others might dislike it.

To facilitate the provision of in-class feedback, the system from Shannon et al. (2016) incorporates several features like question scaffolding, and pseudonymous or anonymous participation to provide security, voluntary participation, voting, and reflection support. This study advises future studies to implement scaffolding into the giving of feedback to ensure that the feedback that is being given is relevant.

A minority of the participants in the study of Shannon et al. (2016) found the giving of feedback to be distracting for the presenting student, however, most participants did not express distraction as a potential concern, neither when they were presenting, nor giving feedback. Some people had strong feelings about being judged, which might cause problems for these students. In general, people noticed that the amount of feedback given via the in-class feedback tool was significantly higher than without the tool in a traditional presentation setting.

3&4

Objective, Research Question & Methodology

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3. Objective and Research Question

Just graduated primary school teachers with no musical background often lack the musical capabilities, and confidence to teach music. This leaves the music classes at primary school to be simple or skipped entirely. This is problematic for the children who do not get proper musical education, since music is proven to be of utmost importance in a child's development. To put a dent in this problem, this thesis aims to increase learning in music classes at the PABO through an interactive system that enhances the in-class peer feedback process during microteaching sessions. The results of this thesis will not solve this problem entirely, but it should function as a helpful tool educators could implement in their music classes to enhance learning.

Microteaching is a commonly used method of teaching among music educators. These sessions are beneficial for the student who gets to give them, but not so much for the students at a PABO who are following them. This thesis looked into ways of utilizing vicarious learning through the use of peer feedback in microteaching. It is expected that students will more actively reflect on the student in front of the class during microteachings when they are challenged with giving feedback on didactic aspects.

Interaction technology is used to facilitate this process and serve as a framework for educators to implement peer feedback into their microteaching sessions. The technology should not be disruptive, should involve all students in the didactic process, should lead to better-given feedback, and should not be a burden on the educator. To design and develop such a system, the following research question is defined:

> **Main research question**
> *How to design a tool for in-music class feedback during micro teachings that enhances learning for users using interaction technology?*

To answer this research question, first, an initial concept design was created based on literature as well as interviews with multiple music educators who work at ArtEZ conservatory in Enschede, or PABOs throughout The Netherlands. After this, an iterative cycle of real-world experiments with a high-fidelity (hi-fi) prototype of the designed feedback system was conducted. After each cycle, new iterations were made to the prototype to take hold of opportunities that arose during the experiment and to solve the encountered problems.

4. Research Methodology

This research was conducted in four design phases. Each design phase has a different methodology which becomes progressively more representative of a real-world scenario. In every phase discoveries are made, new problems are identified and new possible solutions are addressed. Each phase has its own goal, which is reflected in a research question. These design phase-specific research questions are intentionally kept broad, to get elaborate answers. These four design phases can be seen as four individual small researches which are built on one another.

Each design phase is concluded with an “Issues & the way forward” section. These sections summarize the encountered issues that users have, together with a way forward to solve, work around, or further research these encountered issues. It is important to identify and understand the problems that your users might encounter in the intended context. Only when one fully understands the struggles of their users will they be able to solve them. This approach is based on the “Design spaces” approach De Lange (2022) took in her thesis, and implements aspects of the research through the design method and the design thinking method.

4.1. Design phase 1: Initial design research

This research chapter consists of a literature review, together with six expert interviews. The expert interviews are semi-structured, and highlight problems that they have encountered during the feedback process, how they currently implement feedback in their classes, in what context they use feedback, what factors they deem important for a digital feedback system, and what feedback should be given on. These findings were elaborated with brainstorming sessions and literature and led to a proposal for the design of a digital in-action peer feedback system, which was developed.

4.2. Design phase 2: Expert test

It is unrealistic to expect that all theoretical knowledge is carried without any problems into the design of the system. The system did contain problems that were deal-breaking in a real class scenario. To highlight these problems, an expert test was conducted. In this test, three music educators from the ArtEZ Conservatorium in Enschede did a microteaching session with each other where they took on the role that the students would normally have. A focus group was held after the microteachings to extrapolate information from the session. It was discovered that students do not have time to read high quantities of feedback whilst giving a microteaching. A solution was proposed where the educator takes on a moderator role and decides what feedback the student in front of the class gets to see.

4.3. Design phase 3: In class experiment one

The next step for the tool is a test in a real class. The first time this happened was during a lesson study designed by a graduation supervisor of this project's PhD research. This lesson study focussed on how to optimally implement the tool into a lesson and thus aims to help educators develop lessons for the tool. A thorough design for a lesson was made in which feedback plays an important role together with the project supervisor, and music educators of the PABO KPZ in Zwolle. This design process highlighted new requirements of the tool that were implemented, like the requirement to show and hide feedback criteria mid-session.

The system was not tested before in a real classroom environment with a high number of students. A performance test took place before the system was put in a class, and showed that the system did not work fast enough. Optimizations were made to speed up the application accordingly.

Then the lesson was executed in five different music classes. Unfortunately, these sessions were not physically attendable by me because of personal reasons. Raw results gathered from these sessions by the graduation supervisor in the form of interviews, observations, and survey answers were analyzed and used by me to draw conclusions in this thesis. With these conclusions, new problems for the tool were discovered, leading to proposed solutions, and improvements for the system.

4.4. Design phase 4: In class experiment two

The previous experiment gave insights into important aspects of using the system that were investigated further. This was done in an experiment at the LUCA School of Arts in Leuven. During this experiment, students gave a workshop intended for primary school students in a microteaching session, where they learned to perform an activity on a song. Information was gathered through observations, a survey, and interviews with the educator. It was also investigated if the students who used the tool felt more stimulated by the feedback. This did not yield statistically significant results, but it did give insights into the potential the system has.

4.5. Technical implementation

The development of the system took place during most of the research. It started when the main concept was clear in the first design phase and ended for this thesis when the final changes were made that were required to conduct the final experiment. An iterative development cycle was used, which means that every time the feedback tool was tested, improvements to fix encountered problems were made, resulting in a new iteration of the feedback tool. Development of the product continues after the final thesis is finished. These changes will be part of future research and will not be addressed in this thesis.

To enhance the process and get insights into the work that is still left to do, some elements from the Scrum methodology were used in the development process. A Trello board was created with a "Backlog", "To do", "In Progress", and "Done" lane. These lanes contained stories, which did not have scrum points. Labels were used to indicate the priority of the user stories instead. Sprints were not used in this process, since there was no specific planning, or external stakeholder who needed to be aware of the progress. Instead of sprints, the project was seen as one long ongoing timeline.

5

Design Phase One

Initial Design Research

Chapter Goal

The main goal of this design phase is to get a research-based initial design for a digital feedback tool. The choices made during this phase will determine the direction of the upcoming phases and design. Findings in this phase are tested, validated, and elaborated on in these upcoming design phases.

Chapter Research Question

"What should a digital in-class peer feedback system include to stimulate learning in a microteaching setting?"

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5.1. Design methodology

Explorative literature research was conducted to highlight required features and explore how the feedback system should function. Previous research by Minnegal (2023) proposed the following design questions to be answered in this chapter:

- SQ 1.1: What is a good way to give feedback with a feedback system in a musical microteaching setting
- SQ 1.2: What is a good platform to support a peer feedback system in a musical class setting?
- Besides these questions, the following design questions should be answered to make the feedback system fit the established context defined in the background research:
- SQ 1.3: What are the design challenges of implementing a digital peer feedback system in a musical microteaching?
- SQ 1.4: What are interesting ways to further enhance engagement in musical class settings?

The information to answer SQ 1.1, SQ 1.2, and SQ 1.3 were gathered from six expert interviews (Appendix C, D, E, F, G, H). All the interviewees are educators in musical education from three different educational institutions in the Netherlands. Two of them teach music at the PABO, while the other four teach a variety of musical courses at the conservatory. The interviews are semi-structured, and the base questions are the same for all interviews. The aim is to deliver a broad perspective from different professionals on a specific set of topics. The questions aim to discover the context of a musical class, how feedback is currently given in these class sessions, and how peer feedback should be given in an ideal scenario. Bias might occur in one of the interviews since an interviewee is involved in this project as a graduation supervisor (Appendix C).

To explore potential solutions for subquestion 1.4, two methods of brainstorming were used. These methods were the creation of several word webs (Appendix I), and a session of Starbursting (Appendix J), which is a brainstorming method that focuses on asking questions about the topic at hand rather than providing answers according to Kitch (2023). Additionally, potential solutions were identified from the interviews. The ideas were validated with literature, as well as common sense. The research conducted in this chapter was broad but not deep. This approach ensures a broad choice of possible solutions of which the best options were picked and developed. The depth of this research is enhanced in the future design space.

Additionally, literature research was conducted to enrich the data collected in the interviews and brainstorming sessions. This research did not focus on specific keywords to cover an area of research since this was already done in the research topics, instead, it focussed on smaller specific details which are required for answering the research questions. The literature was mainly found via Google Scholar, and some additional literature was provided by the graduation supervisors.

Every subquestion has its subsection in section 5.2. One additional subsection was added for additional findings made during the interviews.

5.2. Research

5.2.1. How feedback should be given

SQ 1.1: What is a good way to give feedback with a feedback system in a musical microteaching setting

This section aims to highlight how to give peer feedback effectively, and how to implement this in a musical microteaching session. Opportunities and pitfalls of peer feedback will be discovered, and different methods of providing feedback will be discussed.

Giving qualitative constructive peer feedback can be challenging. Even though feedback is a learnable skill as mentioned in section 2.3, students often have not practiced this a lot, possibly causing difficulties when they need to give peer feedback. Interviewees (Appendix G, H) highlighted that the quality of feedback provided by some students in their classes can be mediocre. Some students assess a student instead of giving feedback, which is not constructive. Examples of this type of feedback are “Nice” or “not nice”. This type of feedback does not enhance the learning process. When discussions become too assessing during verbal feedback moments, the interviewed educator sometimes has to interrupt the session because it turns into a whining session instead of a constructive feedback session. One of the interviewees (Appendix H) pointed out that making students pay attention to a small set of criteria increases the quality of the feedback that they give. Shannon et al. (2016) took the same approach of asking questions as scaffolding. This yielded positive results for them and they recommend similar systems to include this. In the design of the feedback system, scaffolding will be implemented in the form of questions that need to be answered. These scaffolding feedback questions will be called feedback criteria.

Interviewed experts (Appendix C, F, G, H) mention that in an ideal world, feedback that is given can be immediately given to the presenting student during the microteaching session. The process of giving feedback during a learning process allows students to improve on it in the same activity and is called formative feedback. That formative feedback works well is backed up by researchers. According to Blackwell et al. (2023), the timing of when feedback is given is very important for the quality of this feedback. According to Hardavella et al. (2017), the optimal timing of giving feedback is when the memory is still fresh. Kulkarni et al. (2015) have shown that students’ grades improve when feedback is given within 20 minutes, but not when it is given after 24 hours. To facilitate formative feedback during microteaching sessions, in-action feedback will be used in the system designed in this thesis. This means that feedback is given not after, but during the microteaching sessions. This will give the opportunity to immediately present the feedback to the presenting student.

A graduation supervisor of this project mentioned that one challenge of implementing a peer feedback system in a microteaching session in a music class is that the students are active during these sessions. This means that they do not have a lot of time to give this feedback, leading to the question, how can students give in-action feedback during a microteaching session? To give feedback as quickly as possible, the amount of actions required to give feedback should be limited. This can be done by letting a student select a feedback answer from a predefined set of answers. This speeds up the process of giving feedback, but it also limits the ability of the peer to be constructive since the students can not tailor the feedback towards the performance and context of the presenting student. It can be argued that giving feedback by selecting an answer edges more towards peer assessment,

than peer feedback which results in lesser learning according to Liu & Carless (2006). The interviewed experts were asked about this (Appendix C, D, E, F, G, H), and advised selectable feedback alternatives like a Likert scale, or a rubric because of the speed advantage that they have when filling it in.

A problem that might occur when using this Likert scale is that half of the people might strongly agree, and the other half strongly disagree. This leads to an average result of neutral, whilst none of the voters were neutral. This can be solved using the consensus measure according to Tastle et al. (2015). This measure will score the dispersion between ratings in a consensus scoring, indicating that opinions are divided on a Likert scale. Another possible solution for this is to show the bars per vote individually.

A rubric is any set of criteria that describe the varying degrees of excellence or levels of development in an activity, process, or product. Rubrics help focus on specific attributes or characteristics according to Reeves & Stanford (2009). They also denote that filling in a rubric might be time-consuming at first, but that speed increases when one fills in the same rubrics multiple times, indicating a learning curve to each new rubric. An interviewee (Appendix E) mentioned that a rubric of one might be interesting. This is a simplified rubric that only includes yes/no questions and an open-text field. This simplification is likely to decrease the learning curve resulting in a possible good fit for this project, which was confirmed in other interviews (Appendix G, H).

Shih (2011), Shannon et al. (2016), O'Neill et al. (2019), and Kulkarni et al. (2015) all have developed different peer-feedback systems. A commonality that these systems share is that they mainly use written textual feedback. Textual feedback offers students the possibility to give constructive feedback but is more time-consuming than selecting an answer. A graduation supervisor of this thesis mentioned that a possible solution for this is to add default selectable answers to an open text field, which will fill in the field with only one action. This lets a student choose if they have time to fill in the text field themselves, or if they do not have time to fill it in and select a predefined answer.

Constructive feedback needs to be tailored to a situation or person. Tailoring feedback consumes time, and this time is not always available during a musical microteaching session. This is why a concession has to be made between time spent and the constructiveness of feedback. Which option is best is context-dependent. An interviewee (Appendix C) proposed that this decision should be made by the educator for each microteaching session. To give the educators freedom in how they implement this tool in their microteaching, a Likert scale, open questions, and rubrics of one were all implemented in the design of the tool. An educator can select which question type they want to use for every feedback criteria that they create.

5.2.2. Structure of the tool

SQ 1.2. What is a good platform to support a peer feedback system in a musical class setting?

The system needs to fit the general context of education. From personal experience, the assumption is made that most curriculums of educational institutions are built out of courses. These courses are often taught to multiple classes for multiple years. Courses are not static, modifications to improve courses are occasionally being made. Educators have to set up feedback criteria for a specific course to ma. To avoid repetitive work, educators need to be able to set up a course that can be used to teach multiple different classes for multiple years. A course is taught over several weeks and thus consists of lessons in which the peer feedback system might be required. These course lessons will consist of the feedback criteria and the name of the course in the system. Inside this course lesson, a class

session can be created. This is a lesson that is taught once to a specific class. This class session will store the last version of the feedback criteria. This allows for the editing of the feedback criteria of the course lesson at a later stage without causing mutations in the class session data. Multiple students may take on the teaching role during one class session. To facilitate this, a session can be created inside of the class session, where a student gets the feedback receiver role. In this session, the peers can provide feedback to the student. This process is shown in Figure 5.1 and serves as an initial database model.

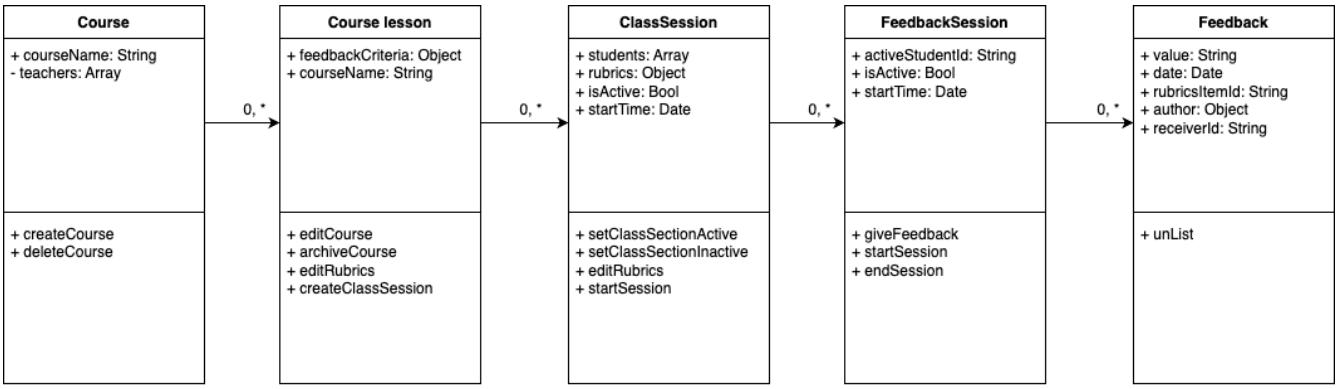

Figure 5.1. Diagram of the expected technical database structure

Based on these workings of the technical core of the system, an activity diagram of the user flow can be derived. This diagram does not show how feedback could, or should be given, it merely shows the intended user journey through the system (Figure 5.2).

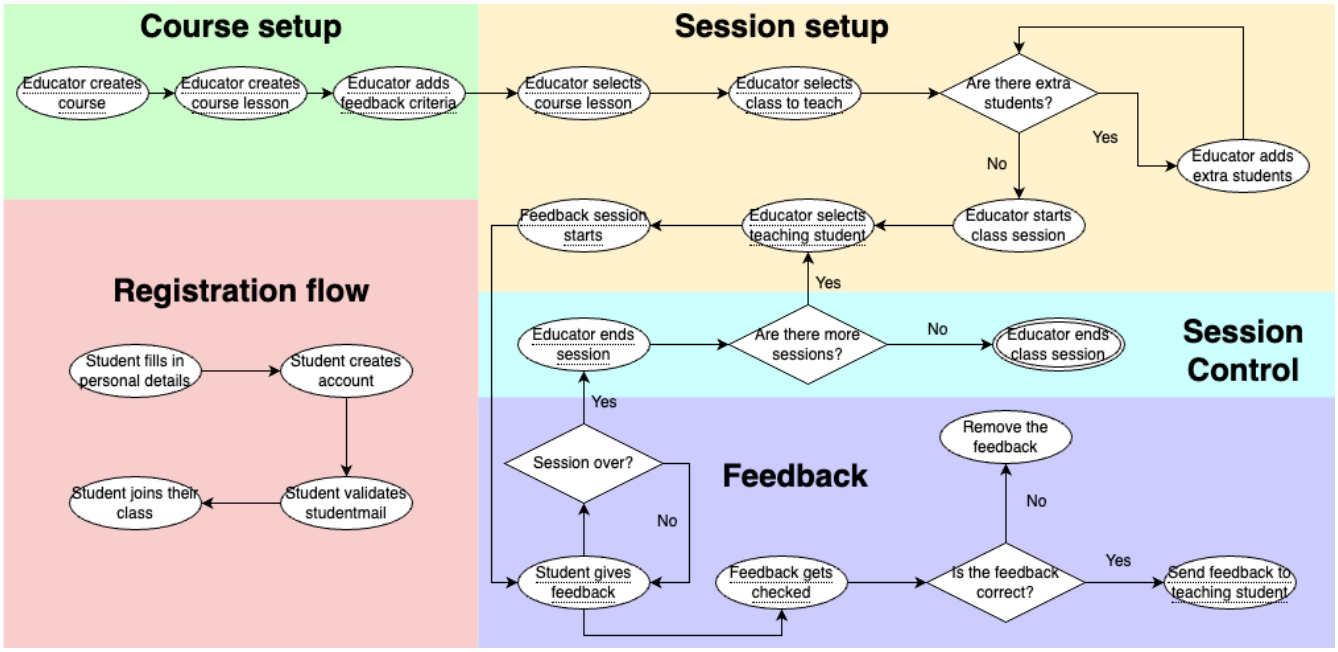

Figure 5.2. The activity diagram of how the core of the application should function in its simplest form

5.2.3. Challenges for technology in a musical microteaching

SQ 1.3: What are the design challenges of implementing a digital peer feedback system in a musical microteaching?

Multiple interviewees (Appendix D, H) pointed out that there is a shortage of time during music classes. This is why the system should not cost any additional time in the class. The in-action nature of the proposed feedback system helps with this since most feedback is given during a simulation

session instead of after, removing a time-consuming aspect and allowing for instant discussion of feedback. One interviewee (Appendix E) mentions that the system can be used to give feedback from home. This is a possible application for such a system, but it can reduce the effectiveness of the feedback according to Hardavella et al. (2017) and Kulkarni et al. (2015) who state that feedback should be given when the memory is still fresh.

Discussion of feedback is important for students according to multiple interviewees (Appendix D, E, F, G). This is another form of vicarious learning, where students can learn from each other. When the most important feedback is not discussed in the class, some students might not have noticed the most important points that they could have potentially learned. The tool is digital, but should not replace the verbal discussion entirely. It should feed this discussion instead with the most important points so that the discussion can be done efficiently.

Students should be active and stimulated during music classes according to interviewees (Appendix D, G). When one student stands in front of a class, the other students follow actively. It is however important for these students to think about the didactics of the class according to an interviewee (Appendix C). The system should help the students pay attention to the didactics, but should not interfere with how active they can follow the microteaching. One interviewee (Appendix D) proposes a possible setting for using the system during a microteaching session where a couple of students will not follow the microteaching but will have the sole task of giving feedback instead. This is expected to increase the quality of feedback given, whilst decreasing the quantity. It is also expected to keep the disruptions in a class to a minimum.

It is human behavior to have self-doubt, especially during a learning process according to one interviewee (Appendix H). Another interviewee (Appendix C) mentioned that compliments can act as an important factor in the learning process. Insecure students are more vulnerable, especially when a student presents something in front of the class. One of the interviewees (Appendix H) mentions that she encountered this during her singing course. She mentions that singing in class, in front of peers, is even more frightening for the students than singing at a primary school. Because students are in a vulnerable position, it is important for the tool to consider the safety of the students. An interviewee (Appendix G) thinks that most feedback given will be positive and that it will potentially even boost the confidence of a presenting student. He says that he thinks that students will not collapse under the pressure of receiving live constructed feedback, as long as the feedback is not being shown to the other students.

One educator (Appendix H) thinks that feedback can become harsh when it is given anonymously. Later, she contradicts herself and says that students of pedagogical education are a certain type of people who do not take shots at each other. These students aim to become teachers themselves, so they are more trained in carrying on knowledge in a correct manner than other students. We should however consider that bullying is always a possibility. The educator should be able to monitor feedback to keep the environment safe, which is agreed upon by the interviewee. Liu & Carless (2006) note that social constructs might get in the way of fair assessments of peers. This is why an anonymous feedback system is seen to be more viable. The previously identified potential pitfalls should, however, be investigated in upcoming experiments.

5.2.4. Enhancing the feedback system

SQ 1.4: What are interesting ways to further enhance engagement in musical class settings?

This thesis aims to optimize learning via a feedback system. A feedback system can be implemented in various ways, and the learning can be enhanced beyond the traditional giving, and receiving feedback. To highlight possible improvements that distinguish this feedback tool from other feedback tools, possible enhancements to the feedback process are discussed.

1. Let the students pick their feedback measures
Different methods of giving feedback have been discussed in section 5.2.1, namely open questions, Likert scale questions, and rubric of one questions. It might be interesting to see what effect it has if students can pick these methods themselves per feedback criteria. This potentially requires the students to more deeply analyze the question that is being asked, since they have an additional factor to consider when answering the question. It also might be helpful for students who have impairments like dyslexia, or autism according to an interviewee (Appendix D), who mentions that students with certain impairments might have a strong preference for a specific input type.

This does however limit the control that an educator has because some questions are designed to be answered in specific ways. It also makes the answers more difficult to display clearly, since similar answers are more difficult to group when they are given in different manners. This will require more actions for the students when giving feedback because they have to decide on and pick their preferred method of feedback for each feedback criteria, possibly enhancing the difficulty of giving feedback in an active microteaching session.

2. Highlight given feedback
After each session, the presenting student can select the feedback that they found most important, and share it with the class to feed a discussion. This might however highlight possible failures of presenting students, making them potentially feel unsafe, vulnerable, or uncomfortable. It can be argued that the most important feedback can be the harshest feedback. Learning from mistakes is however a valid learning method, according to Kim & Miner (2007) (near-)failure situations lead to arguments that reveal fine-grained knowledge.

3. Predicting feedback before a session
Before a session, students can predict what feedback they are going to give. This aims to let them actively think about what could go wrong during the microteaching. They can fill in this feedback in the system, and they can send it to the presenting student whenever a prediction comes out. This can eventually be gamified, where the student gains points from correctly predicting feedback. A possible downside of this can be that students need time before every session to make their predictions, possibly making the tool more disruptive in the class. It also has the potential to make students in front of the class more vulnerable, since it might be unpleasant when people are going to guess what mistakes you are going to make, we figured.

4. instead of giving feedback, ask questions about the class
Students can lack confidence in their musical ability. This might make them hesitant when providing feedback since they are afraid that their feedback is incorrect. By asking questions, they do not have to be correct. Almeida (2012) denotes that the questions of students play an important role in

meaningful learning and motivation. Feedback in the form of questions might also be better for the presenting student since they are triggered to self-evaluate when answering these questions. Giving questions through feedback however is a lot more challenging than providing regular feedback, because students have less experience with giving this type of feedback. Another problem when implementing this in the system is that it is not possible to ask questions via a Likert scale, or a rubric of one.

5. Educational disruption moments

Every student gets one disruption moment in the class where they can stop the class and give a suggestion or tell something educational about the class setting. This allows the students who have a musical background to share their knowledge when they see fit. This is potentially disruptive, depending on the occurrences of the disruptions. We expect that students with higher musical confidence will interrupt the class more often than students with lower musical confidence, improving the learning chances of an interruption. An interruption might however have negative effects on the class. It potentially makes the presenting student feel unsafe, a disruption moment might be time-consuming, especially when multiple interruptions happen, or an interruption can start a long discussion. This is why the power to interrupt a class might be better left to the educator.

6. Class takeover

When a peer notices a mistake, they can press a button and become the teaching student in the microteaching session. This aims to create a game-like environment, where students rotate teaching. This can allow every student to teach with fewer microteaching sessions. Students who need the least practice and already teach well will however be the ones teaching for the longest time in this setting. Other implications with this idea are that all students have to prepare the same microteaching for them to step in, and students who are ill-prepared, or shy have the possibility to easily dodge being the presenting student by not taking over the class.

7. Add competition

Competition can be a motivator for active participation. This can be done through the rating of feedback, or by letting the teaching student pick their favorite feedback and highlight it for the class. A scoreboard can be created so that students can compete to become the best feedback-giver in the class. This is expected to stimulate students to give the best feedback they can, which in turn stimulates active participation. This form of gamification can greatly improve involvement according to Smiderle et al. (2020). This however is contradicted by Challco et al. (2017), who mention that competition is only enjoyable for students who want to be the best performing of a group. Implementing gamification can be a risky endeavor. When not done correctly there is a high chance of it reducing learning according to Toda et al. (2017). They compared gamification studies and found that adding gamification had a negative effect in 12 out of 16 studies for varying reasons.

8. Secret missions

The project supervisors for this thesis had proposed to add secret missions to the project. These are challenges that peers get assigned during a microteaching session. An example of this is that one student is tasked with a secret mission, playing out of rhythm in this case, and all other students in the class need to guess who has the secret mission, and what the secret mission is. This requires the students in the class setting to analyze their other classmates in a teacher-like role. The goal of this is to stimulate an active presence in the class by requiring the students to pay attention to how the entire class is playing music like a teacher normally would. It might be interesting to see if this division

of required attention on the class, and on the teaching student who they have to give feedback on, has a positive learning effect on the students in the class. Olivers & Nieuwenhuis (2005) argue that a division of attention might benefit target detection in some settings, which, if true, indicates that a division of attention is not inherent to a distraction of attention. Division of attention is arguably a required skill for primary school teachers since they are required to pay attention to the children during their teaching. Adding an experience alike to the curriculum might be beneficial for the students. The secret missions should however not be too distracting, or completely disturb the class for them to be effective according to the findings in section 5.2.3. They should be an addition, not a main activity of a microteaching session.

9. Comparing feedback to that of the educator

In a study by O'Neill et al. (2019), students got to compare their peer feedback with that of other students. This had a positive effect since it triggered additional reflection by the students. It might especially be interesting to compare the peer feedback that students gave to the feedback that an educator gave. The educator holds an expert role towards the students, which we expect to lead to additional self-reflection by the students when their feedback differs from that of the educator. Li et al. (2016) found that agreement between student and teacher feedback varies heavily. This might yield interesting results for this experiment since it indicates that educators and students frequently have different opinions. It gives the students a baseline for them to check if what they said was agreed upon, acting as feedback on their feedback. There however is a small chance that this can decrease a student's confidence when their given feedback does not often align with the educator's feedback.

10. Reacting to each other feedback

Shih (2011) conducted an experiment where Facebook was used as a feedback tool. Peers made frequent use of emoticons and likes to react to each other's peer feedback. This indicates that the feedback process does not have to be a one-directional interaction. By facilitating a bi-directional interaction to the given peer feedback with likes, emoticons, and textual comments it is expected that the feedback process will be more natural, leading to more interactions and thus more engagement of the students as shown in Figure 5.3.

When someone reacts with a thumbs up to one's feedback, it has the potential to increase the confidence of the person who gave the feedback, as well as give them a feeling of appreciation, potentially boosting motivation in giving future feedback. Whenever someone does not agree with the feedback that is provided, it can spark a conversation between the two people which can lead to future learning for at least one of these people. This should not only increase the learning effect of the feedback but should also stimulate ownership and add to the responsibility they feel over the feedback that they have given since they might get feedback on their feedback.

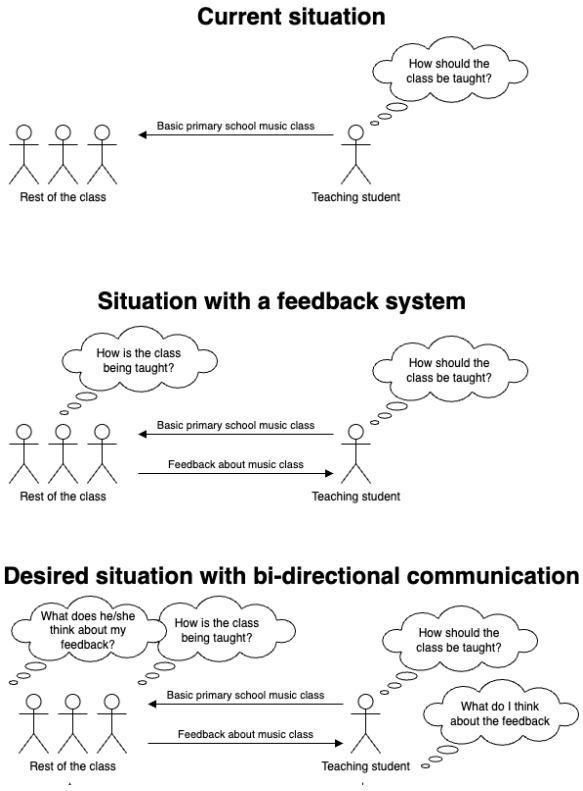

Figure 5.3. The expected effect that adding comments has on the reflection being made by the students

11. Letting students choose if they want to receive the feedback during, or after the session

Students can pick if they want to receive the feedback during the experiment or after. This allows the students to create a learning environment that applies to them. This aligns with what was said during interviews (Appendix C, D), where it was mentioned that different impairments of students might require different approaches to teaching.

According to an interviewee (Appendix D), some students might collapse under pressure when receiving feedback during a class session. This might be caused by an extra cognitive load or a lack of confidence. The interviewee mentions that students who suffer from this are expected to know this for themselves, so giving them a choice might solve this. This was however contradicted by another interviewee (Appendix H), who thinks that students only collapse when the class is interrupted, making the teaching student lose all authority. This interviewee thinks that seeing the feedback would raise the confidence of the students, because they can see how well they are doing, especially with graph-like outputs.

This feature might be redundant, since a student can choose not to look at the screen when presenting, or they can simply close the application when they are doing their microteaching.

12. Summarizing feedback

After each feedback session, a student can summarize the received feedback in four or five sentences. The creation of this summary should not take too long, because that can be disruptive to the class. This summarization of feedback can also be done by selecting a set of feedback items, which might be quicker than typing. This summary of feedback can be used to facilitate the discussion after the class session. As mentioned in multiple interviews (Appendix D, E, F, G) discussion of feedback is an important part of the learning process. One of these interviewees also mentioned that it is important to ensure that the students take a proper look at the feedback. This summary has the potential to act as a bridge between online feedback, and verbal discussion in the class, completing the feedback process.

Conclusion

A set of possible enhancements for the system were discussed. Due to the time limitations of this thesis, and to keep the scope manageable, not all of these ideas were implemented. Most enhancements come with risks, and possible negative effects as well. Feedback should be the central role of the system, and the enhancements should not take away from this. This is why enhancements were picked that enrich the feedback experience. The picked possible enhancements and their implementations are:

9. Comparing feedback to that of the educator

Once given, feedback will be displayed on the page of the active session, this is where the feedback of the educator will be shown beside the feedback that the student has given as shown in Figure 5.4.

10. Reacting to each other's feedback

The presenting student can react to textual feedback quickly by selecting one of the icons under the feedback. A disabled chat button is displayed next to the icons. The student who provided the feedback does not see any reaction, or chat buttons initially. This is to avoid a high number of students initiating a chat with one presenting student. Only when the presenting student reacts to a piece of feedback, the bi-directional communication flow is started between the feedback giver and receiver,

and the chat icon button is enabled. Now the feedback-providing student sees the reaction that was given, with a chat button next to it. There are only three participants in the chat namely, the person who gave the feedback, the presenting student, and the educator. The educator is in this chat to moderate it, and other students in the class can not see, nor join the chat. Feedback with a reaction and a chat from the point of view of a presenting student can be seen in Figure 5.5.

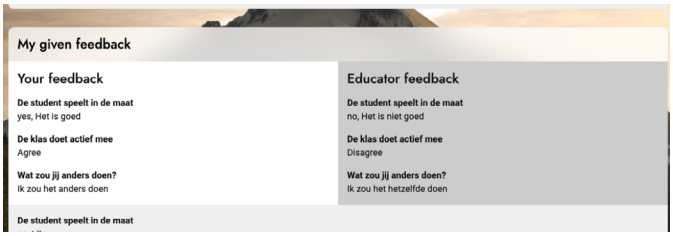

Figure 5.4. Comparing the given feedback to that of the educator

Reacting to other peoples feedback is only possible for textual feedback.

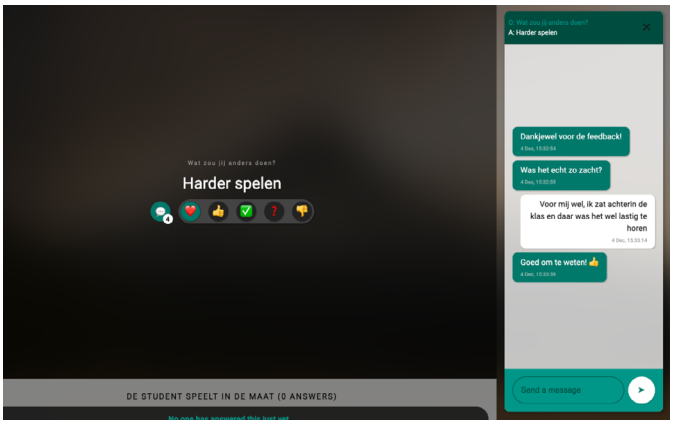

Figure 5.5. Reacting to a piece of feedback through sending a reaction icon, and having a chat

12. Summarizing feedback
After each session, the presenting student will get a feedback report. On this report, they will get an open text field, where they can type the summary as shown in Figure 5.6. To limit the time spent on this summary, they will have a limit number of 150 characters to spend on this summary.

To conduct the experiments properly and test these enhancements, it should be possible for the educator to turn these functionalities on and off.

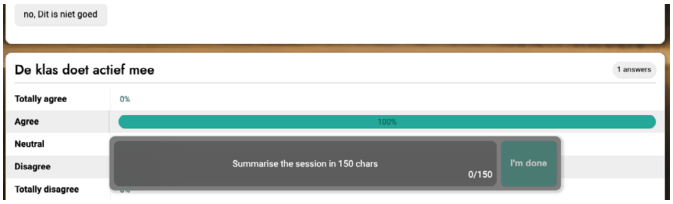

Figure 5.6. Summarizing the feedback after a session

5.2.5. Additional findings

Multiple interviewees (Appendix C, E, F) pointed out that they like to get more insights into what students are doing in the class. One educator sees a division between working and actual learning. He likes to see if students improve over time. Another educator wants to use these insights to see if the lessons match the level of the students, whilst the last educator finds some students lazy and wants to see who is giving a lot of feedback, and who is sitting back and letting the other students do the work.

According to an interviewee (Appendix D) the majority of feedback is currently being forgotten by the students. The system proposed in this thesis can offer students a place where this feedback is stored. An interviewee (Appendix F) thinks that students should be actively stimulated to go back and take another look at the feedback, or they might not look at it again. She says that after an internship a broad discussion occurs where a lot of feedback is given to the students. When this session is done, they get a grade, for example, “more than sufficient”. This grade often is considered to be the most important part, because it says that they passed the internship. They might not care too much about the feedback provided to them during the discussion according to the interviewee. She also mentions that students often think in grades, which the educational program wants to get rid of. They want to create insights into the learning and development of students but currently, it is connected to the pass instead of personal development.

One educator (Appendix D) pointed out that sometimes multiple students at once have to give a microteaching. This is why he requested the possibility for multiple students to be the presenting student.

5.3. Issues & the way forward

This section acts as a summary and discussion of this chapter. Each paragraph in this section is linked to a specific section of previously discussed theory. It does contain duplicate findings from these previous sections by design, since only reading the “Issues & the way forward” section should provide enough insights to grasp the results of this design phase. Because this is an initial design phase, there is significantly more overlap between the results and the way forward then in the other design phases. The source section number is added in between brackets at the end of each paragraph.

It was found that students can have difficulties giving constructive feedback. Interviewees (Appendix G, H) pointed out that the quality of feedback can be lackluster by some students, not reaching further than “Nice”, or “Not nice”. This is why scaffolding was proposed in the form of feedback criteria to which the students have to adhere. These criteria are feedback questions about the didactic process, like those used in the experiment of Shannon et al. (2016). An interviewee proposed a similar approach to scaffolding (Appendix G). (Section 5.2.1.)

Feedback should be given quickly because of the active nature of microteaching sessions. This can be done via a Likert scale, or a rubric of one since these methods allow students to quickly select what they think, instead of typing it. Open questions can however provide more context, which is why the educator can select which method is used for giving feedback per feedback criteria. (Section 5.2.1.)

Feedback is most valuable right after a mistake has been made. This is why the feedback is presented immediately to the presenting student. One thing that should be prevented is cognitive overload for the students. The next design phases took a deeper dive into the possibilities, and problems that occurred when presenting feedback directly to the presenting students. (Section 5.2.1.)

A microteaching session can be a vulnerable moment for a presenting student. Some students lack confidence according to interviewees (Appendix C, H). To protect the presenting student, the educator should be able to monitor what feedback is being given, so that they can intervene when necessary. Feedback might be too harsh as said by an interviewee (Appendix H), but there is no way of knowing if this is true beforehand. This will be researched in the upcoming design phases. (Section 5.2.3.)

Time is limited during musical classes according to multiple educators (Appendix D, H). To preserve time, the system should not put a burden on the educator, or the students during the class. This is why the preparation of the feedback criteria should be done in advance, and the system should not add time-consuming tasks during the class sessions. The nature of in-action feedback is helpful for this since it lets students provide feedback during the activity, which would’ve been provided after the activity otherwise leaving more time for a valuable discussion afterward based on the already given feedback. (Sections 5.2.2, 5.2.3.)

The introduction of a digital feedback system does not mean that all the feedback should be given digitally. The system should in some way feed the verbal discussion because a verbal discussion is important for vicarious learning to students according to multiple interviewees (Appendix D, E, F, G). (Section 5.2.3.)

To further enhance the feedback process, experimental additions were added to the system. These include letting the students summarize the feedback after each session, to let them reflect on the feedback that had been given. We expect that this summary can be used to better discuss feedback after a session. The ability to compare the given feedback to that of the educator should be added to the system, to give students a baseline to reflect on the feedback that they had given. The last proposed addition is a comment and chat system so that students get the possibility to communicate anonymously with each other based on feedback. We expect this to clear up misconceptions and increase ownership over given feedback, potentially enhancing the quality of the feedback given.

6

Design Phase Two

Expert Experiment

Chapter Goal

The main goal of the upcoming chapter is to catch invalid design decisions before the system is tested in a real class. This was done by simulating a real class with experts in music education from the ArtEz Conservatorium in Enschede. This will lead to a list of alterations that need to be made to make this system feasible in a real class setting.

Chapter Research Question

"What needs to be changed to the system before it can be used in a real music class during a microteaching session?"

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6.1. Experiment setup

To validate if the developed tool connects to the target audience, and to potentially catch possible improvements in the design, a “sanity check” was conducted. This was done with some of the educators in the musical field who were interviewed. The goal of the experiment was to take a dive into the workings of the system and to validate if the developed features connect to the context that the educators teach in. Three experts who are available during the same timeframe at the same location were required for this.

There are multiple ways of doing experiments of this form. Most forms focus on UI/UX optimization, which is not the goal of this design phase. A fitting method for validating if the features of a digital system work is identified as an expert review in a simulated realistic setting because this shows the workings of the tool in a realistic context and thus highlights possible flaws in the system. The experts were instructed to conduct a musical microteaching session. They all had to prepare an exercise that could be performed in five minutes. Three participant roles were defined for this experiment, namely Educator, feedback-giving student, and feedback-receiving student. After each microteaching the experts switch roles into a role that they had not had previously. This ensures that every expert has been in each role once.

To supplement the small sample size of three educators, the researcher partook in the experiment in the role of a student who gave feedback whilst following the microteaching session. This ensured that there were two students in the class during the experiment instead of one. Because the researcher was occupied with participating in the experiment, feedback could not be written down which possibly led to the loss of some data. Partaking in the experiment also has benefits. Experiencing using the tool in a realistic setting can yield valuable data.

During the recruitment, participants were informed about the contents of the experiment including the requirement to perform a five-minute microteaching session and the fact they will receive feedback based on a predefined set of criteria through a digital tool. They were informed about the session duration of one hour and 30 minutes, and its intended location which was the conservatory of Enschede.

During the previous design phase, educators were interviewed and asked which feedback criteria they would like their students to give feedback on. A list from these suggestions was created (Appendix L), and three criteria from this list were picked based on popularity and relevancy. As mentioned in section 5.2.1, the tool supports giving feedback in three different ways (open question, Likert question, and rubrics of one). The three picked criteria will all include a different method of giving feedback to ensure that all methods are validated.

There is a good balance between talking and playing. (Likert scale question)
Does the person get the attention of the class? (Rubrics of one question)
How does the person speak? Think about speed, openness, and tone. (Open question)

No heuristics were defined for this experiment since this research did not focus on individual criteria. Instead of this, finding possible improvements and testing the feasibility of the system in the classroom is the goal.

6.2. Procedure

When all required participants were present in the experiment room, a recap was given of the session goal and the session plan. A walkthrough of the system was given after this in the form of a demo. This was done to ensure that all the experts knew how the system worked. This complete introduction took about 15 minutes. After this, the microteaching sessions took place. Some sessions took longer than five minutes as expected, because experts had to set up their sessions and switch roles. In total 35 minutes were spent on the microteachings. This left 40 minutes for the focus group.

Next, this focus group was held to gather the thoughts of the experts about the implementation, and feasibility of the tool. A set of predefined questions (Appendix K) bound to specific topics were asked which helped structure the discussion. Discussions for all questions were timeboxed, which ensured that all questions could be covered equally, and avoided that the experiment took up more time than planned.

At the end of the experiment, the participants were asked for their final thoughts, which might lead to possible improvements, and/or a confirmation that the system functions properly according to them.

6.3. Results

The results of this experiment are based on the focus group (Appendix M). This section is divided into four subsections, based on the topics defined in the focus group questions (Appendix K).

6.3.1. Giving feedback

All participants agreed that they would like to submit multiple pieces of feedback. In the current implementation of the system, it was only possible to give feedback to each criteria once and alter this at a later time. One participant pointed out that during a session, the presenting student started talking not clearly, but fixed this later in the session. He wanted to give the feedback in two stages so that the presenting student could see the improvement that they made due to changing sentiments in feedback. This missing functionality is not considered to be a dealbreaker according to the participants, but one participant mentions that it is not doing justice to the potential of the system when this functionality is missing. Unfortunately, implementing this will require a technical overhaul of the system, which was not possible due to the time constraints of this research.

The feedback form, where they had to give feedback was clear according to the participants, but there was a lot of scrolling for one of the participants on their phone. This is a common drawback of using a phone, known in the software design space, because of the reduced screen size. The tool was built with a desktop-first approach but should work on phones as well since laptops might not always be available during active microteaching sessions.

One participant pointed out that it can be challenging to think about what feedback to give while executing the exercise. Another participant liked the Likert and rubrics of one question during the microteaching session and the open questions after the microteaching session.

6.3.2. Receiving feedback

One of the participants pointed out that they did not have the time to read seven or eight pieces of feedback when they were in front of the class. He mentioned that attention on the screen would be required for about ten seconds to comprehend this feedback. This is problematic since it interrupts the microteaching experience. The amount of feedback increases further when the class sizes increase, making this problem potentially even more significant. One of the participants proposed a “Thermometer” which turns green or red to more quickly interpret feedback. There were already progress bars visible for the Likert and rubrics of one question in the overview, but textual feedback can not be displayed clearly in a progress bar.

Another suggested solution to avoid this cognitive overload by an interviewee was to place the educator in a moderator role. In this role, the educator would receive all the feedback instead of the presenting student and can forward it to the presenting student when they see fit. This reduces the amount of feedback shown to the student and ensures that the feedback shown to the student is deemed important by the educator.

6.3.3. Extra features

A participant was worried that the chat functionality would result in spam. The chat functionality already has spam prevention, however, as mentioned in section 5.2.4. One participant points out that it felt illogical to first select a reaction icon before being able to chat. He tried pressing the disabled button multiple times during the session but was not able to open the chat. To avoid this confusion, the chat icon should not be shown at all when no reaction icon is selected. This aims to let users automatically find out that they can chat after selecting an icon when they get more familiar with the system.

The participant’s opinions were mixed about comparing one’s feedback to that of the educator. It was mentioned that an educator is not a “know-it-all”. The question was asked what a student would do if the feedback did not align with that of the educator. Is the student going to reflect on it, or are they going to copy the feedback of the educator blindly? A one-sided look is also bad was argued, and agreed upon by the participants.

The participants mentioned that the summary will help the students to remember the feedback that they have received. One educator compared it to a cheat sheet. He said that he always allows cheat sheets in his class because the students will remember what they wrote on it. He thinks this is the same for the feedback summary. A concern arose, however, about how feasible the summary is when a higher quantity of students give feedback. During this session, feedback was received from two students and one educator. In a class of 30 students, it will be more difficult to summarize the feedback in only 150 characters in a short period. The feasibility of this summary was investigated further in the upcoming in-class experiments.

It was suggested that whilst the presenting student is summarizing the received feedback, the other students can summarize the feedback that they have given. It was observed during the session that the other students did not have a lot to do while the presenting student was summarizing.

6.3.4. General remarks

A participant felt like the discussion was missing after the microteaching session, which made the feedback loop feel incomplete. The discussion was left out intentionally because of time constraints. Another participant mentioned that he thinks a hybrid approach would work with this system, where the initial feedback is given digitally during the microteaching, and discussed verbally after the microteaching. The importance of a discussion after feedback was also highlighted in section 5.2.3 and should be investigated further in the upcoming design phases.

It was mentioned that the chat functionality might be redundant. They would use the platform to give feedback, but not as a place for discussions. They doubt if the chat is going to be used a lot by the students.

Video recordings might be a valuable addition to this platform like in IRIS Connect according to one of the interviewees. IRIS Connect is an online platform for reflection, knowledge sharing, and collegial consultation according to IRIS Connect (n.d.). Using video would help students recall what feedback was given. This has great potential for connecting feedback to a moment, because the timestamp when feedback is given is stored, meaning that the feedback can be displayed on the video at the moment it was given. Even though this feature would be an enhancement of the system, it is out of scope for this thesis because it mainly benefits the storing and evaluating of feedback, whilst this thesis focuses on the in-class feedback experience.

The participants found the design to be user-friendly. It was mentioned that students can give information quickly, the experts think that the use of a Likert scale and rubric of one is fine. It is a good feature that the presenting student can see if they are doing well, or rectify mistakes if they made any.

6.4. Issues & the way forward

The biggest issue encountered was an overload of feedback for the presenting student to comprehend, or even read during a microteaching session. To reduce this overload, the educator got a new role as a feedback moderator. As a moderator, the educator receives all the feedback during the microteaching instead of the presenting student. When feedback is essential for the presenting student, the educator can choose to forward it to the presenting student. We call this forwarded feedback “Whispers”. The whisper is only visible to the presenting student for a short amount of time to decrease distractions. The time that a whisper is shown (T) is calculated with “T = 2000ms + (75ms * L)”, where L is the number of characters in the whisper. This formula was found by trial and error and ensures that the shortest whispers are at least shown for two seconds, but that longer whispers can also be read. The entire screen is black with nothing on it for the presenting student when no whispers are visible. Once an educator sends a whisper the screen turns white, and the whisper will be displayed in black text for the duration that the whisper is visible after which the screen will turn completely black again. We expect that students will notice the screen turning white when it is in their peripheral vision.

Because of their new moderator role, Educators can no longer give feedback like the students. This led to additional design challenges. The educator needs to be able to let their findings be known to the presenting students, and should not be limited by the feedback that the peers have given. This is why a feature was introduced for educators to type custom whispers besides forwarding feedback. Another

encountered problem is that students no longer can compare their feedback since the educator no longer gives feedback. The educator does send whispers that can be compared to the feedback, but these whispers are not bound to criteria, making a direct comparison more challenging.

It was noticed by the experts that thinking of feedback, and giving it whilst following a microteaching can be challenging. To make this easier, the experts advised using selectable feedback, like the Likert scale and rubrics of one question during the microteaching sessions, and letting the students fill in the open questions after the session.

To keep students focussed, and optimize time usement in musical classes, a feature was implemented in the system where students can summarize their own given feedback whilst the presenting student is summarizing all received feedback. We expect that this will further enhance self-reflection for the feedback giving students.

The experts think that the chat functionality won't be utilized a lot by students, and they think that it might be redundant when a verbal discussion is being held. This is why the chat features a less prominent role in future experiments. It was not removed from the tool, but the participants of the upcoming experiments were not notified about the chat functionality. This means that students can choose for themselves if they utilize the chat or not. If people utilize the chat without any notice beforehand in the upcoming experiments, it means that students do need such a functionality, and it can feature a more prominent role again in future research. If the chat is not used, we can assume that it will not be used in a real scenario, and it will be removed entirely from the feedback tool.

7

Design Phase Three

Class Experiment One

Chapter Goal

The main goal of this chapter is to detect and resolve the implications of implementing the in-action peer feedback tool in a real class. This was done via a study executed in five PABO classes at the Hogeschool KPZ in Zwolle. This led to a set of alterations of the tool, and guidelines on how it should be implemented in a class.

Chapter Research Question

"How should the system be used in a music class to be as least disruptive as possible, while enhancing the class session?"

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7.1. Experiment goal & setup

The main focus of this design phase is to discover how the tool should function in a class. This was done with three phases, namely a lesson design phase (Section 7.2.), a performance test phase (Section 7.3.), and a lesson execution phase (Section 7.4.). These phases have separate methodologies and results, and propose changes to the system. This is why they were set up in the form of individual studies. They were executed in chronological order.

The lesson design phase was executed with PABO educators of the Hogeschool KPZ. The goal of this phase is to explore how classes usually are taught at the KPZ, and how the system fits in these classes. Then a lesson was designed that incorporates the feedback system, and a suitable set of feedback criteria was created for this lesson. At the end of the lesson design phase, changes to the system were made to accommodate the designed lesson.

The system had not been tested with more than four users at once before this experiment. This is why a performance test was conducted before the tool was put into the class. 30 accounts were simultaneously giving feedback, in a worst-case scenario setting. The goal was to check if the system did not crash under high loads, and to identify if the system worked fast enough. If the system did not work fast enough, performance optimizations were identified and implemented.

Then the lesson execution phase was started using the previously designed lesson in five music lessons in different classes, including 76 students total. The goal of the lesson execution phase was to highlight functionalities of the system that work as intended, discover problems that occur in a real class scenario, and propose solutions to these problems.

7.2. Lesson design phase

This is the initial lesson design phase, which serves as a preparation for the execution phase. During this phase, alterations will be made to the system if this is required. After this phase, the system should be ready to be put in a classroom. This phase was done in collaboration with a graduation supervisor of this project.

7.2.1. Study design

The lesson designed in this section replaces an existing lesson that would have been taught if this experiment was not conducted. This means that the same learning goals should be achieved. This study was designed by a graduation supervisor of this project who is an educator in music himself. This supervisor developed a lesson design tool in the form of a table (Appendix N) with questions based on the feedback types defined by Hattie & Timperley (2007). This table was designed to extract feedback moments from the learning activities. The table was filled in based on the activities that the educator would have used in their original lesson (Appendix Q, R). Based on the extracted feedback opportunities, an identification was made for possible activities where the feedback system could be implemented. The information from the table was used as a base to construct the feedback criteria.

After this lesson design phase, a script for a lesson with multiple activities that work towards a learning goal was developed. Moments where the feedback system was used were identified, and

a feedback set was created based on identified feedback opportunities. The feedback system was altered based on newly discovered requirements during the development of this lesson.

7.2.2. Procedure

The lesson design phase consisted of three stages. These stages can be defined as “Introduction”, “Design”, and “Implementation”.

The introduction stage consisted of one physical meeting between two educators at the KPZ, the researcher, and the graduation supervisor who designed the experiment. Everyone in this meeting first introduced themselves, then an introduction, and demonstration of the system was given led by me. To give an optimal demonstration of the tool, all the participants in the meeting were a part of the demonstration. The graduation supervisor was in the role of the presenting student, the educator role was filled by me, and the other participants were in the role of students who gave feedback. The other participants were able to see the screens of the researchers, and we guided them through the actions that we took. One full feedback flow was demonstrated.

To make the designed lesson fit the original lessons’ learning goals, the educator responsible for the lessons was asked to explain what the normal lesson would look like. This clears up the context and desired learning opportunities of the lesson. Then a brainstorming session was started led by the graduation supervisor. The goal of this brainstorming session was to discover potential use cases for the feedback tool in the explained lesson context, to discover what such use cases would look like for the educator and students, and to get clarify what actions needed to be taken to include these findings in the lesson.

After this first session, the design phase of the study was started. The explained lesson in the introduction session was broken down into individual parts. The parts of the lesson in which feedback was used were extrapolated, and analyzed by filling in a form created by the graduation supervisor as mentioned in section 7.2.1. to analyze how the feedback should be implemented. Finally, the entire lesson plan was written down in a script which can be followed during the lessons (Appendix S).

Finally, the feedback tool was set up for the designed lesson. First adjustments were made based on newly discovered requirements that were highlighted during this lesson design phase. Then the defined set of criteria was created in the tool. This was done together with the educator who leads the lessons, to let her get a better grasp on the system. When the set was added, a short practice session was conducted together with this educator. During this session, the educator was controlling the feedback tool, like she would in the class. Supervision was given to ensure that she would not get stuck by the researcher.

7.2.3. Study results

7.2.3.1. Lesson design & feedback moments

The learning goal of the experiment lesson was that a student needs to be able to lead a song in a primary school according to the educator who led the lesson.

The educator usually starts a lesson for this learning goal by giving an example of how to lead a song, whilst the class follows. She then lets the students break down the steps that she took whilst leading

the song. She writes these steps down on a whiteboard as they are named correctly by the students until all the steps are there. Then the educator proceeds to give a couple of intentionally bad examples of how to lead a song with one or two missing steps, and students have to identify which steps are missing. This should make students pay attention to the steps that are taken when leading a song, and help them see the importance of these steps.

This was identified as a feedback opportunity in which the tool could be used. Instead of using it for giving feedback, the students can use the tool to select the missing steps in the process. This is expected to lead to more involvement in the class, since not only one student can answer verbally, but all students can answer online. It also shows the educator how many students have given the correct answer, so it can help her identify when to move on to the next exercise.

When this exercise is done, the educator usually gives a recap of the strategy of leading a song. She mentions the importance of practice, and feeling comfortable whilst leading a song. She tells the students that they can help each other by giving compliments, tips, or correcting each other. Then she instructs the students to practice leading a song in small groups using microteaching. This is again an important feedback moment, but unfortunately currently not suitable for the tool. With the current tool, there can only be one feedback session active per class session. This means that it is not possible to have multiple feedback sessions simultaneously within one class. Developing this feature will be an overhaul of the system, and is not feasible within the constraint timeframe. Thus, for this part of the lesson verbal feedback will be used instead of the tool.

After this, the educator usually instructs the students to form a singular group again. The educator asks if a volunteer student wants to practice in front of the class. A microteaching session with the entire class will be conducted. This is done for three to five students each lesson. This was identified as a good moment to include the peer feedback system in its intended way.

The educator also wanted to investigate the learning progress of the students. This is why she proposed to show reflective feedback questions at the end of the session. They also help students reflect on the entire lesson and set goals for the future.

7.2.3.2. Feedback criteria set

In section 7.2.3.1, three different moments were identified where the feedback system could be used. For each moment, a set of feedback criteria will be defined. The original feedback criteria were written in Dutch, but for this report, they were translated into English.

The difficulty should increase gradually for the students during the first activity. The educator will give multiple wrong examples of how to lead a song. After an example, she can decide if it is time to increase the difficulty. There are seven steps in total for leading a song, but only three of these steps are shown in the options. This limits the amount of steps that the students have to take in mind. The criteria were defined as follows:

> **Question**: 1. Which step of the strategy is missing?
> **Type**: Multiple choice (new functionality, see chapter 7.2.3.3.)
> **Options**: “Search for starting tone”, “Take over the starting tone”, “Let the opening tone be repeated”

The next criteria ask the same, but with all the possible missing steps to choose from, and the plural of

step, so that students know that there was more than one step missing:

> **Question**: 2. Which steps of the strategy are missing?
> **Type**: Multiple choice
> **Options**: “Search for starting tone”, “Take over the starting tone”, “Let the opening tone be repeated”, “Make eye contact”, “Breath in and show start signal”, “stroke at the right pace”, “Make closing sign”

To further enhance the difficulty, students were no longer told if there were one, or multiple steps missing:

> **Question**: 3. Which step or steps of the strategy are missing?
> **Type**: Multiple choice
> **Options**: “Search for starting tone”, “Take over the starting tone”, “Let the opening tone be repeated”, “Make eye contact”, “Breath in and show start signal”, “stroke at the right pace”, “Make closing sign”

For the second activity, three feedback criteria were defined. The first two criteria are based on the filled-in table (Appendix R) and directly relate to the learning goals of the class session. The last criteria is an open feedback question, to ask what further improvements the student can still make. The set was defined as follows:

> **Question**: 4. The student in front of the class executes the strategy flawlessly.
> **Type**: Rubric of one
> **Tags**: “Good that you remember all the steps!”, “Have you really had eye contact with everyone?”, “Make your gestures a little bigger/clearer”
>
> **Question**: 5. The student in front of the class looks very comfortable.
> **Type**: Likert scale
> **Tags**: -
>
> **Question**: 6. What can the student improve for the class? Choose below or give another suggestion.
> **Type**: Open
> **Tags**: “Pay attention to the correct pitch of the starting tone”, “The deployment gesture was not very clear.”, “Is everyone paying attention?”, “Remember the tapping point when tapping!”

The third feedback activity is a reflection on the session. This is why the following two feedback criteria were shown to the entire class at the end of the session:

> **Question**: 7. What do you know now about the strategy of leading a song that makes you feel more comfortable performing it?
> **Type**: Open
> **Tags**: -
>
> **Question**: 8. What do you want/need to practice well for next time?
> **Type**: Open
> **Tags**: -

In section 6.3.4, it was identified that selectable feedback is more feasible during active sessions. During the first and second activities, students need to do more than one thing than giving feedback (Paying attention to missing steps, and following a microteaching). This is why all but one criteria include selectable question types. The final activity is a reflection on the class. This is an activity where they only have to provide feedback, thus open questions are chosen.

7.2.3.3. Alterations to the system

For the first activity where students had to select what steps the educator was missing, a multiple-choice question is required. This option is added to the system as an additional method of giving feedback besides Likert scale questions, rubrics of one, and open questions. An example of a multiple-choice question is shown in Figure 7.1. When creating a multiple-choice question, the educator can decide if multiple answers can be selected, or if only a singular answer can be selected.

For the third feedback activity where the students reflect on themselves, the possibility for the educator to be the receiver of feedback instead of a student was added as shown in Figure 7.2. All the students will give feedback like they normally would, and the educator will see their regular moderator interface, without the whisper functionality since there will be no one to whisper to. This allows all students in the session to give feedback.

There were three feedback sets defined for this class session. Previously it was only possible to have one static feedback set, meaning that the educator would be required to restart the session if the feedback criteria changed. After this alteration, the educator can show, or hide feedback criteria during a session. A functionality like this was also mentioned during the expert experiment in section 6.4. This functionality is implemented by adding eye icons next to the criteria as shown in Figure 7.3.

Figure 7.1. A multiple choice question with two items selected

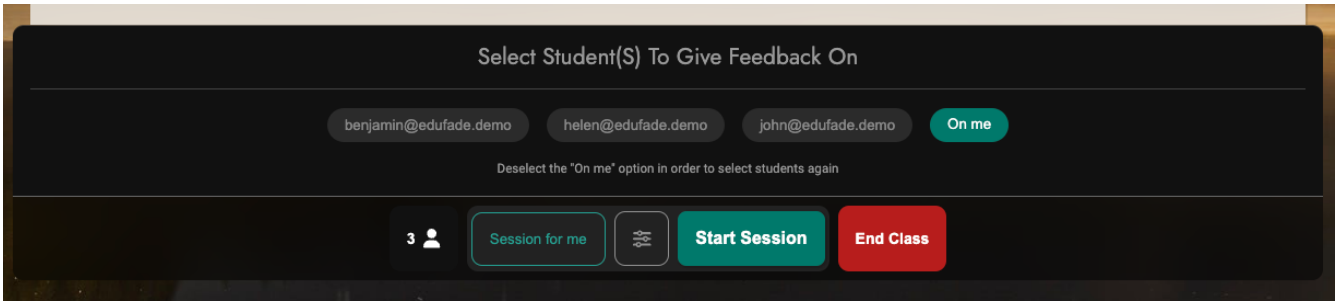

Figure 7.2. The educator has the “On me“ option selected

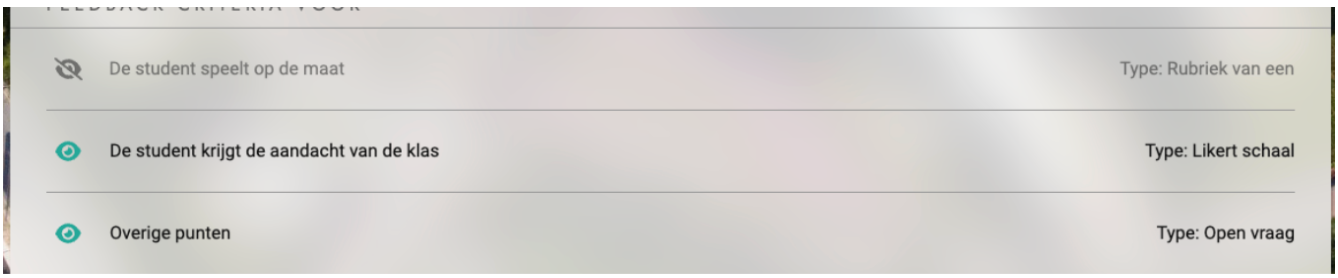

Figure 7.3. Feedback criteria on a class session overview can now be hidden by the educator

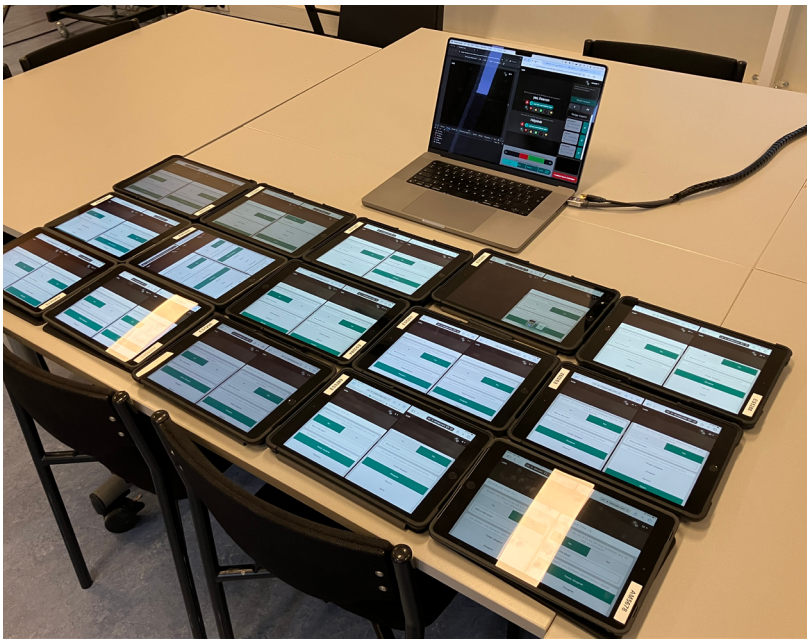

Figure 7.4. All devices that use the feedback system during the load test

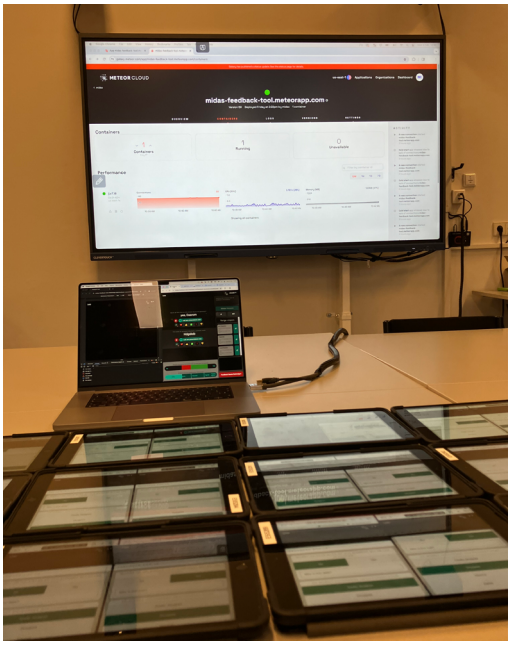

Figure 7.5. The load test being executed with a performance monitor visible on the beamer

7.3. Performance test phase

The system needed to support up to 30 students at once in the largest class during this experiment. The system was being hosted on the free plan of Meteor Cloud, a platform specialized for hosting meteor applications according to Meteor Software (n.d.). From experience, we learned that most free plans work sufficiently for prototypes, but prototypes hardly have to function with high workloads. To identify the impact of a worst-case scenario event where 30 users give feedback at once, a performance test was executed with the platform. This test was conducted together with the graduation supervisor who is involved in this study.

7.3.1. Study design

15 iPads and one MacBook were used for this test. All devices were logged in on two accounts at once in a split screen. The MacBook was logged in on an educator account, and an account for the feedback receiving student. All iPads were logged in as feedback giving students as seen in Figure 7.4. This totals 32 connections at once, of which 31 are students. all the accounts were sending and receiving live data from the feedback system. The laptop was hooked up to a digital school board and displayed the performance monitoring software of Meteor Cloud as seen in Figure 7.5.

7.3.2. Procedure

First, the MacBook opened the site and logged in with one educator account and one student account. Then the iPads were configured never to sleep and to have a split screen open with two versions of Safari, one incognito, and one regular. Both safaris had the feedback tool open and were logged in to different student accounts.

Then a class session was started via the educator account. Notifications for this session appeared on the iPads. The “Visit session” buttons in these notifications were pressed in an as short as possible timeframe. When all the accounts were in the class session, a feedback session was started. All

accounts gave feedback as quickly as possible during this session. The educator account was used to send whispers simultaneously. Finally, the feedback and class session were closed by the educator.

7.3.3. Study results

The application speed varied greatly depending on the task that was being executed. When a class session was started, the notification appeared instantly on all devices. When the feedback session started, the form appeared instantly too. Other tasks like visiting the class session with all the iPads, or logging in on all iPads at once took up to a minute. When all iPads gave feedback at the same time, a significant delay was noticed, and the loss of some data was observed. The difference in load times might have to do with the amount of requests that are done. When 30 accounts click a button and visit the class session, 30 requests are sent to the server. When an educator starts a class session, only one request is being made, and 30 clients are being notified. We expect that the lost data occurred because of server timeouts, and thus is solved when the system works faster.

As mentioned in section 5.2.3, time is important during a class session, and waiting one minute for the system to load a page is not desirable. Section 5.2.1. discussed that feedback should be instantly shown to the presenting student, making the delay in feedback problematic. In its current state, the system does not work fast enough to serve a class of 30 students who execute actions simultaneously.

It is noteworthy that this test was a worst-case scenario. 15 iPads were placed closely together, and feedback was given by two persons on as many different iPads at once as possible, meaning that multiple items of feedback were sent every second during an extensive timeframe. That the system did not crash can be considered a positive result. We do not expect that students would give feedback with the same frequency as tested during the in-class experiment.

To identify possible inefficiencies in performance, MontiAPM was installed on the system. MontiAPM helps users understand what is happening inside their meteor applications, and identify worthwhile optimizations according to MontiAPM (n.d.). Only possible minor improvements were found in the performance of the tool by using this software. We estimated these improvements to not yield noticeable results to the application, meaning that the API's code was considered optimized enough for the experiment.

Another possible problem for the app slowing down might be a full event loop according to Galaxy Docs (n.d.). Meteor is built on NodeJS, which is a single-threaded environment. To make a single-threaded application handle different requests at once, an event loop is used. This is a stack of events which are to be executed. If this event loop is filled up with tasks, it will slow down the performance. It is possible to run certain tasks as background tasks. This would however not work for the feedback system since all jobs need to be executed immediately. If this was the problem, the only fix for the performance would be to get faster hosting with a more powerful thread that can handle the required amount of events. Switching hosting providers was not an option, however, because of time restrictions. Only a couple of days were available, and would likely not be enough to set up a deployment process, so the decision was made to spend time on other possible performance-enhancing features.

All tasks that performed poorly in the performance test were dependent on the database. The database was hosted with the same free plan as the application itself and thus might be the

application's bottleneck. A way to speed up the database is to introduce database indexes for frequently accessed content. A database index works like a bookmark in a book. It makes content quicker to be found based on a categorical variable. This improvement lets us find feedback for a feedback session more quickly for example. These indexes were added to the system before the class experiment started.

7.4. Lesson execution phase

After the lesson was designed, the speed of the tool was tested, and alterations were made to the tool accordingly, a lesson could be taught at the KPZ. This was done with 76 students divided into five different classes over two days. Unfortunately, The execution of this experiment was not attendable in class by me due to personal reasons, but all raw information gathered during this phase (Appendix P, T) was sent to me by the graduation supervisor.

7.4.1. Study design

The chat functionality and the comparison of feedback to that of the educator were disabled for this experiment to focus more on the implementation of the system in the lessons instead of the workings of the system. This can be done via the settings mentioned in section 5.2.4.

Students gave feedback on their phones since they did not have a desk available to put a larger device on. We expect that this affected the usability of the feedback tool since the application is more user-friendly on a larger screen. Due to the active nature of a music class, a phone might commonly be the only available method of accessing a website, which means that this mobile-only type experiment potentially yields valuable insights.

All participating students were asked to fill in a survey at the end of their class session. This survey was constructed by the graduation supervisor and it included general questions about what the students thought of the class, what they thought of the feedback process, what their general stance is opposed to technology, and what they thought about the implementation of technology in this lesson (Appendix O). After each session, one or more students were interviewed by the educator or the graduation supervisor. In total seven students were interviewed (Appendix P).

To ensure the privacy of the students, KPZ was provided with a list of accounts that the students can log in to. The login names of these accounts were connected to the survey, and interview answers so that we were able to tie the answers that they had given to their given feedback. All feedback that was given via the tool is stored in the database and can be used for analysis purposes.

7.4.2. Procedure

Before the lesson started, the educator gave an introduction about the study, and a consent form was handed out to all the students which they had to fill in. Then the three lesson activities as mentioned in section 7.2.3.1 were executed. After the lesson, the students had 10 minutes to fill in the survey, and if time allowed for it, a verbal discussion about the tool was held. A step-by-step script which was followed during the lesson was created by the graduation supervisor (Appendix S).

A research through design-based iterative approach was taken, where problems with the designed

lesson were identified during a lesson, and a possible solution was implemented in the next lesson. An overview of the alterations can be found in table 7.1 and will be discussed in section 7.4.3.

Lesson	Changes
1->2	Students log in before the class start in order to have less delays. The phone was replaced with a iPad for the feedback receiving student.
2->3	Students were asked to put their phones in Do not disturb mode, and to put their phones away when they were not needed. There was not a lot of time left for the final activity, so three students were tasked with giving feedback whilst the other students followed the lesson as usual. This form of implementing the tool was discussed in section 5.2.5.
3->4	No changes were made.
4->5	In the last round of the final form, all the students were tasked with giving feedback via the tool again, instead of having three students set aside.

Table 7.1. The changes made between the lessons of the in-class experiment

7.4.3. Study results

7.4.3.1. Disruptions caused in the class

That the tool did not work fast enough was observed in the class, mentioned in surveys, and mentioned during interviews. Students had to wait for over a minute until they could log in during the first session for example. In section 5.2.3 the importance of not consuming additional time in the class was mentioned, but the tool delivered the opposite causing major disruptions in the class. From the second session on, students were asked to log in at the start of the session, instead of when the tool was required. This did speed up the beginning of the lesson but did not get rid of the disruptions caused by the tool. We do not expect that the alterations made in section 7.3.3 have had the significant impact on the speed of the system that was hoped for. This means that the system ran problematicly slowly for the duration of this in-class experiment, impacting the results negatively.

Interviewees in classes one and two mentioned that having a phone accessible, and receiving notifications is distracting. This was backed up with results from the survey. When a notification was received, it was tempting for the students to open another app. This is why it was decided from the second lesson on, to ask all students at the beginning of the lesson to put their phones away when they were not using them, and in “Do not disturb” mode. This seemed to be effective since interviewees in later classes no longer complained about notifications being distracting. Students did however still mention being distracted by their phones in the survey, which might be an unavoidable side effect of using mobile phones in education. In the upcoming design phase, additional attention should be given to how distracting technology is for the students.

7.4.3.2. Problems encountered whilst using the tool

It was noticed during the first session that a phone screen was too small for a feedback-receiving student to read the whispers that they’d received. This is why from the second session on, an iPad was given to the presenting student to receive feedback on. This resolved the problem entirely.

Some students mentioned in the survey that they did not find the tool clear. The only constructive feedback that was given about unclearities in the interface was that it was not clear when feedback was sent. We expect this to be caused by the lack of a sent button. Feedback is automatically sent

to the receiver to reduce the amount of actions it takes to give feedback. At the moment of this experiment to indicate that feedback was being sent, a loading spinner appeared when feedback was being sent, and disappeared when feedback was sent. How easy the tool is to use might also be impacted by how the lesson is taught. In Table 7.3 it is visible that students found the system increasingly easier to use, whereas in the final class, only one person voted neutral, and all other 14 students voted easy, or very easy.

Students mentioned in the survey that they had difficulties giving feedback during a musical microteaching session. This might be unavoidable due to the active nature of these sessions. One thing that might have an impact on this, is the use of a phone to give feedback. Phones are known to be more difficult to use than laptops, due to their smaller size and lack of a physical keyboard.

7.4.3.3. Concerns of students

An interviewee pointed out that students are vulnerable in front of the class. There is a possible feeling of being judged. The interviewee who pointed this out did however not receive feedback using the tool, meaning that this was a concern instead of an experience. The validity of this concern should be explored further in future research. Another concern was pointed out in an interview that it would be easy to record someone with a phone. This would be a breach of privacy, and especially harmful during microteaching since this was identified as a vulnerable moment for students in section 5.2.3. This was not noticed during this experiment but should be monitored closely in upcoming experiments. It might be beneficial for some classes to mention before a class starts that filming is not allowed. An educator should be the judge of the necessity of this comment for each class. A way to solve this problem is to use devices that have no cameras on the back, like laptops to give feedback.

It was pointed out by an interviewee that students might be affected by negative feedback. This concern was also voiced by an interviewee in section 5.2.3. We however believe that negative feedback, as long as it is constructive, can be as, or even more valuable than positive feedback. Because the educator has a moderator role, they can ensure that vulnerable students do not get exposed to harsh feedback during their microteaching sessions by not whispering it to them. After the session, the presenting student can see all the feedback that was given by their peers, including negative feedback, unless the educator decides to delete this feedback. No harsh, or overly negative feedback was given during the experiment in any of the classes. Most questions were answered with compliments, and one or two critical comments, giving a nice mixture of positivity and constructiveness as seen in Figure 7.6.

Students pointed out that they were concerned the system in its tested form might not have an edge on verbal feedback. This concern is possibly caused by the disruptions of the classes that were introduced by the system. It should be investigated in the upcoming experiment if this request for verbal feedback is still being made when the system runs faster.

7.4.3.4. Positive findings

A change made due to time limitations in the third and fourth classes was that during the final exercise, three students were set aside and tasked with giving feedback instead of following the microteaching. All other students were following the microteaching as they usually would. This setting was proposed in section 5.2.5 and identified as possibly viable. When microteaching sessions are short, it was noticed that there often is no time to give feedback. This way of using the tool helped give high-quality feedback during shorter microteaching sessions.

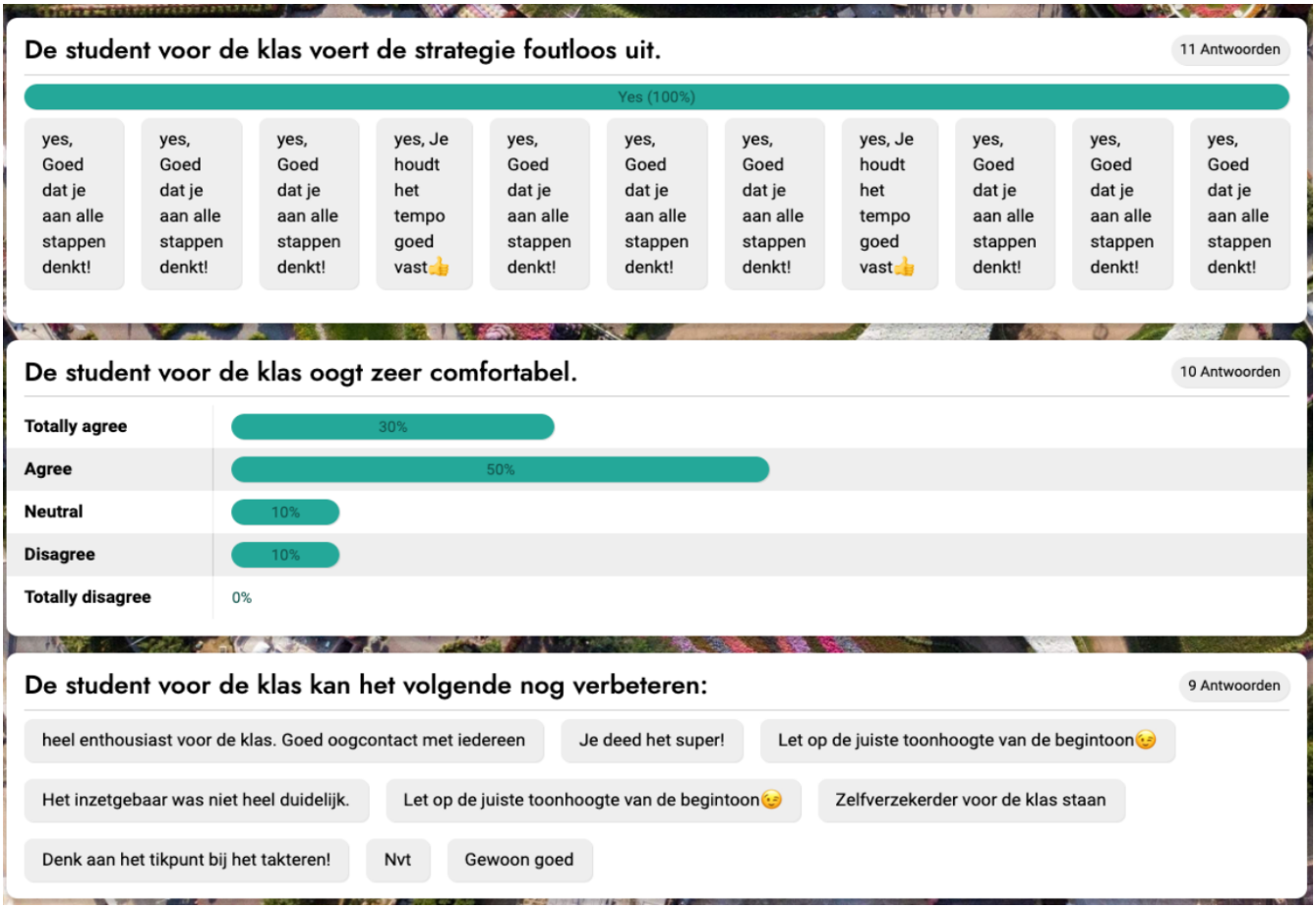

Figure 7.6. Feedback given during the last microteaching of class five

Students also expressed appreciation for certain aspects of the tool. Students liked having feedback criteria because it allowed them to give feedback in a more structured manner they mentioned in the survey. Some students also noted that they were more actively reflecting on how microteaching sessions were being taught due to the challenge of giving feedback. Because all students can give feedback at once, feedback was being given in higher quantities than usual according to the surveys. Some students mentioned on the survey that they noticed they were more activated, which we found an impressive result after only one session.

The favorite aspect of the tool by most students was the part where the educator gave the wrong example, and they had to guess which steps were missing. This functionality was not an intentional use case for the feedback tool but was identified as promising during the lesson design phase. The fact that this not intentionally intended feature was so well received by the students leads us to believe that the tool might have more useful hidden use cases that have not been discovered as of yet.

Because of the alterations to the lessons, a positive trend was visible in the sentiment of the survey's Likert scale questions as shown in tables 7.1, 7.2, and 7.3. In all tables, it is visible that from class three on, the sentiment of the students has improved significantly. The difference between the first and the last class is more than one Likert scale point on average over all tables and shifts the sentiment from being negative (3 or worse) to positive (better than 3). The second class scores the worst. There were no major alterations made between the first class and the second one, except for changing the moment that the students log in on the platform. The second class was the biggest, meaning that the application would have to deal with the most traffic, slowing down the tool the most. We expected that this was the main reason for the decreased sentiment. The shift in sentiment from negative to

positive also shows that the changes made to the implementation of the tool in the class have had a significant impact on how the students experience it, making this experiment a success.

Hoe sta jij tegenover het gebruik van apps en websites voor het leren in de opleiding?
1= Heel negatief, 5= Heel positief

Class	Answers	N	μ
1	2, 3, 2, 2, 3, 3, 3, 2, 3, 4, 3, 4, 3	13	2.85
2	3, 4, 1, 4, 3, 3, 4, 4, 3, 3, 4, 3, 3, 3, 4, 3, 3, 3, 3, 3, 3	21	3.19
3	4, 4, 4, 3, 3, 3, 5, 4, 3, 4, 4	11	3.73
4	2, 4, 3, 3, 4, 3, 4, 3, 3, 3, 3, 4, 2, 4, 3, 3	16	3.19
5	4, 4, 4, 4, 4, 4, 4, 3, 4, 4, 4, 4, 3, 3, 3	15	3.73

Table 7.2. The sentiment of the answers to the first likert scale survey question

3b. Hoe makkelijk heb jij kunnen werken met de technologie?
1= Helemaal niet makkelijk, 5= Heel makkelijk

Class	Answers	N	μ
1	2, 3, 2, 4, 4, 3, 2, 3, 2, 3, 4, 4, 4	13	3.08
2	2, 3, 2, 3, 2, 3, 2, 2, 2, 2, 1, 4, 3, 3, 3, 3, 2, 3, 2, 3, 3	21	2.52
3	4, 4, 4, 2, 2, 4, 4, 4, 3, 4, 5	11	3.64
4	4, 5, 4, 3, 4, 4, 4, 4, 5, 4, 2, 4, 3, 4, 3, 4	16	3.81
5	4, 5, 4, 4, 5, 4, 5, 5, 5, 3, 5, 4, 5, 3, 5	15	4.4

Table 7.3. The sentiment of the answers to the second likert scale survey question

3c. Hoe tevreden ben jij met hoe de technologie is toegepast in de les?
1= Helemaal niet tevreden, 5= Heel tevreden

Class	Answers	N	μ
1	2, 3, 2, 2, 3, 3, 3, 2, 3, 4, 3, 4, 3	13	2.69
2	3, 4, 1, 4, 3, 3, 4, 4, 3, 3, 4, 3, 3, 3, 4, 3, 3, 3, 3, 3, 3	21	2.48
3	4, 4, 4, 3, 3, 3, 5, 4, 3, 4, 4	11	3.36
4	2, 4, 3, 3, 4, 3, 4, 3, 3, 3, 3, 4, 2, 4, 3, 3	16	3.56
5	4, 4, 4, 4, 4, 4, 4, 3, 4, 4, 4, 4, 3, 3, 3	15	3.53

Table 7.4. The sentiment of the answers to the third likert scale survey question

7.5. Issues & the way forward

The in-class sessions have clearly shown that the application needs to work faster. To make this happen, better hosting is required. The used Meteor hosting is expensive compared to their competitors, which is why DigitalOcean was chosen as the new hosting provider. Multiple hosting plans were compared, and tested with a similar performance test as described in chapter 7.3. The cheapest plan that could run the system, and was able to handle the worst-case scenario of the performance test was picked. This process of testing and picking a plan is described in more detail in section 9.4.

The use of phones caused multiple problems during the experiment. It was noticed that students get

distracted by phones, that students have difficulty giving feedback quickly on phones, that phones are not big enough to easily read received feedback, and privacy concerns were voiced by students who were concerned about the possibility of someone making a video recording on their phone. It might be interesting to see if these problems also occur when other devices, like laptops are used to give feedback. This might however not be desirable during this thesis, because of the active nature of musical microteaching sessions. Future research can discover the possibilities of the tool in other courses, like linguistical ones, for which the use of laptops is more suited.

Some students were confused about when the feedback was being sent to the recipient. To indicate this more clearly, a textual comment was added which will be shown for one second right after someone has sent feedback as shown in Figure 7.7.

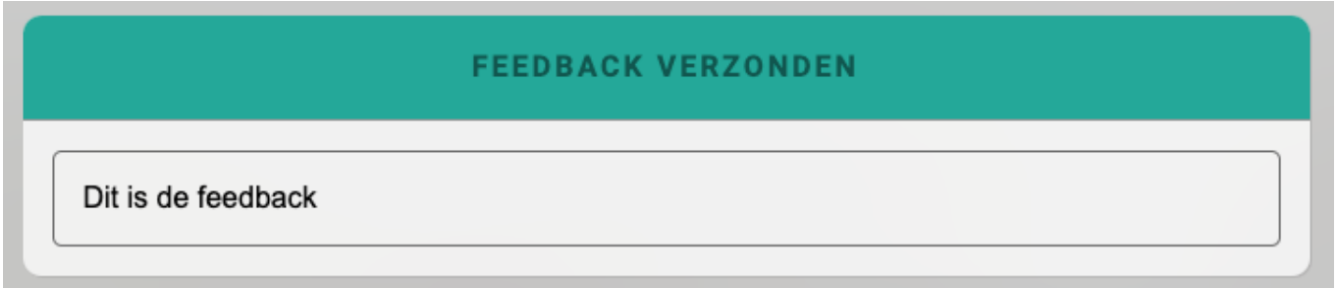

Figure 7.7. A textual comment confirming that feedback has been sent

The main goal of this study was to identify how the tool should be used in the classroom. The change in student sentiment from the first to the last class as discussed in chapter 7.4.3.4 has shown that the implementation of the tool is of utmost importance and that the findings of this chapter are likely to be valid. Based on the findings, a document with guidelines and considerations for implementing the tool in a music class was created (Appendix u) which we advise users of the tool to use.

A feature requested by the educator was the possibility to give multiple answers to a singular feedback criteria. This was also requested during the expert experiment and discussed in section 6.3.1.

8

Design Phase Four

Class Experiment Two

Chapter Goal

Previous experiments have tested the system thoroughly, highlighting problems that have given way for solutions. The tool should be beneficial in a class, and enhance the experience instead of disturbing it. This was tested during an in-class experiment where multiple microteachings were conducted.

Chapter Research Question

"To what extent does the tool lead to a beneficial peer feedback experience during microteaching sessions in the classroom?"

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8.1. Experiment design

8.1.1. Experiment introduction

Music pedagogy students of the conservatory LUCA School of Arts in Leuven will give an experience concert at a primary school. This is a concert which involves the participation of the audience. Before the concert starts, students will provide workshops for the primary school children. In these workshops, the primary school children will learn how to participate in the performances at the concert. Examples of what this participation can consist of are singing, body percussion, or a dance. For the students to practice giving these workshops, microteaching sessions were held. This experiment was conducted in a lesson where students taught these workshops using microteaching sessions.

The goal of this experiment is to discover if the solutions proposed in the study at Hogeschool KPZ are effective, or ineffective. It also brings new problems to light, for which solutions will be proposed. There is a control group during this experiment, and this will be used to determine if the quality of feedback is higher and to compare how actively the students are giving feedback compared to the experiment group.

8.1.2. Experiment setup

For this experiment, subquestions are defined. These questions are designed to validate the solutions proposed in section 7.4.3 and to measure the effect that the tool had on students.

- *SQ 4.1. In what ways does the technology disrupt the class?*
  - Is the tool still disruptive with the faster hosting?
  - Are the students distracted by their phones during the microteaching sessions as encountered during the experiment at KPZ hogescool?
- *SQ 4.2. What impact does giving peer feedback have on the activation of the peers?*
  - Do students feel stimulated to more actively reflect on the processes in the microteaching session?
  - What differences does the educator notice in the student's behavior when using the tool?
- *SQ 4.3. Do students feel like there are better alternatives to handle the feedback process?*
  - In section 7.4.3.3 it was denoted that some students were concerned that the tool in its current form did not have an edge over verbal feedback. Hence this question aims to investigate if, after the alterations made to the system, students still feel like there are alternatives that can handle the same process more optimally.
- *SQ 4.4. How did receiving whispers during the giving of the workshop impact you?*
  - The system has not been tested with a lot of feedback recipients due to the nature of the previous experiments. During this experiment, every student will get in the role of feedback receiver, giving more insights into the effectiveness of this part of the system.
- *SQ 4.5. What difficulties do the students encounter whilst using the tool?*
  - In section 7.4.3.2 some students mentioned that the tool they did not find the tool clear. With this question we aim to highlight usage problems with the tool that are not resolved as of yet.
- *SQ 4.6. How much do the students feel like they learn from the feedback process?*
  - Students from the control group will be compared to students from the experiment group.

Data for this experiment was gathered through surveys. The survey questions (Appendix V) are based on, and tied to the previously defined subquestions. The students filled in the surveys at the end of the class sessions. The control group got a stripped-down version of this survey. Besides this, observations were made based on observer criteria (Appendix W). These observation criteria are tied to the subquestions. Besides the educator, there were two observers during the experiments. One was the researcher, and the other one was a neutral observer who had previously not been involved with this project to reduce bias. A limited set of three observer criteria was used to keep focus during the session. Noteworthy findings beyond these criteria were also written down by the observers. When all the class sessions were done, the educator of the class was interviewed. The interview questions asked were based on the observations made during the sessions. Two weeks later another interview with this educator took place. This was done because one of the graduation supervisors took an interest in these findings for his research. He was not able to make it to Leuven during the experiments because of personal reasons, but he did want to ask some questions to the educator. He led the second interview which was attended by me.

To ensure anonymity for the participants, they all received an account on the tool to log in. This account can not be traced back to them personally. In opposition to the experiment conducted in Chapter 7, all possible features of the system were activated during this experiment. This means that the students were able to chat and summarize their given and received feedback, and all peers got insights in the whispers that the educator had sent during the microteaching to compare to their given feedback.

One alteration is made to the system, namely, that the minimal amount of characters in the summary will be increased from 150 to 500. This is because the educator was worried that 150 characters might not be enough for the students to write a proper summary.

To ensure that the educator who leads the class sessions knows how the system works, and what its capabilities are, an introduction to the system was given where the educator was able to practice with the system. During this session, she used the system like she would in real class scenarios under the supervision of the researcher, similar to what was done in the previous chapter, and described in section 7.2.1.

8.1.3. Lesson setup

The experiment was conducted in two classes over the course of two days. One class of first-year students which consisted of 12 students on the first day, and one class of second-year students which consisted of eight students on the second day. Sessions took place in two different classrooms simultaneously, which means that only half the students were observed by the researcher. This is why the students who can not be observed will act as a control group. In total six microteachings were observed, and executed with the feedback tool, including a total of 11 students. The control group was not working with the feedback tool and consisted of seven students in total. A workshop is given by two students and takes about 30 minutes for the first-year students, and about 50 minutes for the second-year students. Some second-year students give sessions alone, which last about 30 minutes. The goal and contents of the sessions are the same for first and second-year students.

The educator of the class mentions that the results of the control group of this study might be impacted negatively by the fact that she is not present in the classroom of the controlgroup. She

usually takes on a role as moderator of the feedback process. To add scaffolding for the feedback process of the control group, they were given feedback criteria on paper and were required to give verbal feedback on all these criteria. This might however still might be less effective than a verbal feedback session led by the educator.

Before the lesson started, the researcher introduced himself and the neutral observer. Also, a short explanation about the experiment and workings of the tool was given in front of the class. Students were told to put their phones into do not disturb mode, according to the designed guideline (Appendix U). Then all students received a consent form, and the microteaching sessions started. The planning was tight during the first day, leaving no time for a verbal discussion of feedback after the microteaching sessions. A verbal discussion was not planned for the second day either to keep the experiment consistent. The students however took action themselves and started discussing the feedback verbally whilst creating the summary.

A laptop logged in with an account that would be the feedback receiver of all sessions was placed in front of the class. This ensured that students did not have to bring a device with a larger screen than a phone themselves, and ensured that the students did not have to log in again when they got feedback speeding up the session. This means however that the students are not able to access the feedback via their account. This is why screenshots of the received feedback were sent to the students so that they could use it after the experiment was done to improve their workshops.

This laptop was set up on a table. The table was placed in front of where the presenting student was expected to stand. On the left, there was a class computer, which was used for putting on music. There also was a piano present, which was used by some students during their microteaching sessions. The chairs for the students were put in a circle. The observers and educator sat in the back of the class to not distract the students whilst being able to observe them properly as seen in Figure 8.1.

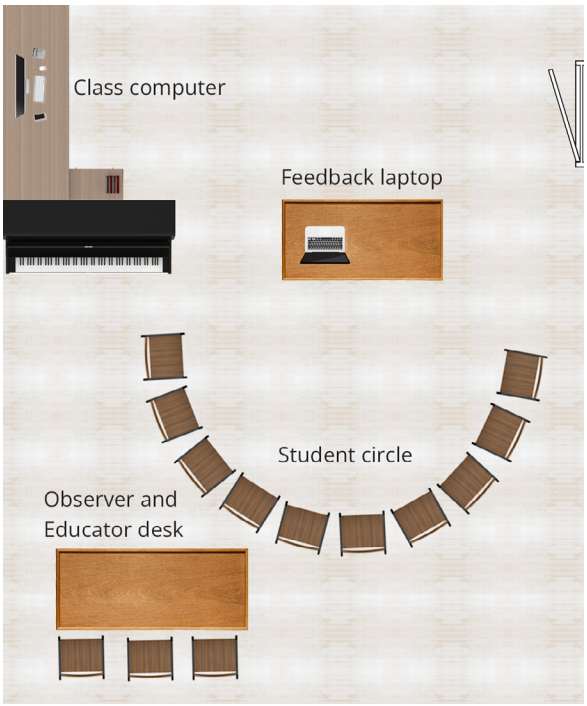

Figure 8.1. The class setup of the experiment at LUCA Leuven

Because the students did not have a desk and were expected to be active during the class, they had to use the tool on their phones. This did cause some problems during the previous experiment but was unavoidable for this experiment. The system should work correctly on phones, as previously mentioned, it is often not possible to use other devices in this type of session. It would be interesting in the future to conduct an experiment on laptops, or tablets to see if this has a positive effect on the feedback that is being given as mentioned in section 7.5.

8.1.4. Feedback setup

The feedback criteria were created together with the educator and a graduation supervisor. First, important aspects of giving the workshop were discussed. The aspects that were important according

to the educator, were that the instructions given by the student should be clear, the student should implement non-verbal communication, peers should be musically stimulated, and peers should be active. Also, the build-up of the activity is important.

The tool was used in two stages for every microteaching. The first stage consists of feedback during the microteaching sessions, the second stage is for feedback after the microteaching. This was done because some feedback can not be given during a session since it is reflective of the entire performed task. Because of the success of the missing steps exercise as discussed in section 7.4.3.4, students were asked a similar multiple-choice question after each microteaching, where they had to select which forms of communication were used. The second phase of feedback also included some open questions, because students are not active anymore during this phase.

The students need to reflect on the entire class session according to the educator. This is why a third stage of feedback was added at the end of the class sessions. Students were asked which useful tips they had gotten, if it was clear what they had to rework after the microteaching, and they were asked how they were going to rework the workshop. In this stage, the educator was the receiver of feedback. This reflection moment was not only important for the students but also for the educator, because it gave her more insights into which students needed additional help, and which students were on the right path.

The second-year students are further in their musical development than the first-year students. This is why some of the feedback criteria were formulated differently for both classes. An example of different questions are “How was the activity structured”, and “What do you think of the structure of the activity”. The first question was asked to the first-year students. It is a more literal question, which should be easier to answer. The second-year students were asked what their opinion was about the structure.

This resulted in a set of 11 feedback criteria, using all the different feedback types available in three stages of feedback (Appendix X).

8.2. Results

The observations of the researcher (Appendix Y) and the neutral observer (Appendix Z) are used to gather information for the upcoming chapters. Both interviews with the educator (Appendix AA, AB) were analyzed and used, together with the survey results from the experiment (Appendix AC) which was filled in by 10 students, and the control group (Appendix AD) which was filled in by four students.

8.2.1. Disruptions caused by the technology

SQ 4.1: In what ways does the technology disrupt the class?

Most students agreed on the survey that the tool was not disruptive. 20% of the students voted “Not a disruption at all”, whilst 40% voted “A minimal disruption”. 20% were neutral and the final 20% found it “disruptive”. This matched the findings of the observers, who denoted that students were not visibly distracted a lot.

Students were observed timing feedback moments strategically and thus gave feedback at moments

when it was least disruptive. We expect this to be possible because of the long duration of the microteaching sessions. Based on the observations made in Chapter 7, we expect that the students would not have been able to find these strategic feedback moments in shorter sessions. An example of a strategic moment to give feedback is when the presenting student is switching to a new exercise, and the peers have nothing to do for a short duration. Sometimes feedback was given during an exercise, but this did not seem to have a major impact on the session. People were seen reaching for their phones, but not getting them because an action was required in the microteaching. We infer from this that some students prioritize microteaching over giving feedback. When someone reaches for their phone, it means that they want to give feedback, which in turn means that they are actively thinking about how the session is being taught. The educator mentions in an interview that students were able to, and allowed to, ignore the feedback tool if they seemed fit which made the technology no distraction at all according to her.

During one of the sessions, a disruptive moment in the class was observed. For the workshop, students were put in pairs of two and tasked to speed date with each other based on a topic they received. One of the students said out of nowhere “Nu ga ik even feedback geven”, which translates to “Now I’m going to give feedback” after which he grabbed his phone and started looking at it. This stopped the speed dating session fully and was disruptive for himself, and the other person whom he was doing the activity with. The feedback that he wanted to give was textual, however, he was only able to answer yes/no and Likert scale questions on the form. He decided to stand up and walk to the researcher in the back of the class to ask how he could give textual feedback. This increased the disruption of the class even more. We infer from this that some students can have more difficulty with providing feedback in a non-disruptive way. We expect these difficulties to decrease as students become more familiar with the system.

At the beginning of most microteaching sessions, students were sitting on their chairs in a circle. Some students put their phones on their thighs whilst sitting. When the students were tasked to stand up, some students forgot to take their phones with them. We expect that it can be distracting for all students when phones are lying around in the classroom since the screens can turn on randomly when one gets a notification. The owners of the phones were seen taking detours when moving through the class to pick up their phones, causing minor distractions.

Students were not seen using their phones for anything else than giving feedback during microteaching sessions. A couple of students were seen texting in between microteaching sessions. This mostly happens at the end of the day, which implies that distractions might increase when sessions take longer and students get tired.

One of the students who found the technology disruptive mentioned that the class was small, resulting in a big part of the group dropping out of the activity when they gave feedback. The other students who voted disruptive, found the technology disruptive when they were given the microteaching session. They propose something like a light in the back of the class when a whisper is sent. It is however not clear from the survey why a light that turns on is less distracting than a screen that turns on.

8.2.2. Impact of giving peer feedback

SQ 4.2: What impact does giving peer feedback have on the activation of the peers?

Feedback was not given as frequently as expected. During the first session, only two pieces of

feedback were given during the entire microteaching. During one other session, no feedback was given at all. We expect the low amount of feedback given to be caused by the active nature of the sessions. The educator mentions in an interview that first-year students give feedback in lesser quantities inherently than second-year students. Because of the lack of feedback given, extra time was allocated after every session to give feedback. Most students were observed giving feedback at this moment, which leads us to conclude that the problem of a lack of feedback is indeed caused by the active nature of the session. This is concluded through the exclusion of the possibility of the students not having anything to say, or not wanting to give feedback. This confirms the conclusion that the students prioritize following the microteaching sessions over giving feedback as mentioned in section 8.2.1.

During the last microteaching of the first day, the control group joined the experiment group (after filling in the survey) since they were done with their session. Now there were 10 students following the microteachings of which six were experienced with using the tool. 15 pieces of feedback were given during this session. This means that every student gave 1.5 answers on average which is a lot higher than during the other sessions. This might be caused by the fact that the session stopped for a while when the student was putting on a song, creating a timeframe for the students to give feedback. The fact that this was the last session of the day, and the students got more familiar with the feedback tool might also have impacted this result.

60% of the students did not feel like giving feedback influenced how activated they were during the session. 30% of the students found that they were less involved, and 10% found that they were more involved. Two students say that the feedback criteria helped them focus more concretely, and made them think about the microteaching session. One student says that they were distracted by the feedback whilst one said that they were not able to execute the exercise properly when giving feedback.

8.2.3. Receiving whispers during microteachings

SQ 4.4: How did receiving whispers during the giving of the workshop impact you?

A lot of students did not seem to have an eye for the laptop which was placed in front of the class. This might be because of the active nature of the class sessions. The entire classroom was often used to give the workshop, including instruments like pianos. This means that the laptop was not always visible. Some students tried positioning themselves in the class to level more with their peers and seem less of an authority figure. Most students did not see the whispers during their microteaching session. The educator expects that this is possibly impacted by a learning curve. She thinks that the whispers can be precious for the students, but that the students need to learn the value of these whispers before they will keep the laptop more actively in mind.

One of the students pointed out at the end of the class session that she was afraid that receiving feedback might be too distracting during microteaching sessions for her. She was one of the students who did not have an eye for the laptop. She might have intentionally ignored the laptop because she was afraid to be distracted. We should consider that there are differences between students. Some students might not find it distracting to receive feedback during an activity whilst other students might find it distracting.

We tried to place the laptop in the view of one of the students during one microteaching session. The student said that she was going to sit in a circle on the floor with the students, so the laptop was

placed on the floor behind the peers so that they were not able to see the whispers. This worked okay for the first part of the session. For the next part, music was put on and the students had to walk around the classroom on the music. One student thought that the laptop was in danger, and used this moment to pick up the computer and put it on the desk. The laptop was no longer in sight of the presenting student for the remainder of this session. The student who put the computer away also had to interrupt her microteaching to do this. From this, we conclude that microteaching sessions are unpredictable, which is a problem when trying to position a device in the view of the presenting student.

There was one group of two students who did have a good eye for the whispers, showing the potential of the tool. During this session, three whispers with improvements were sent to these students of which they saw them all. The first feedback whisper was given six minutes and 16 seconds into the session. The student in front of the class is instructed to talk louder. She glares at the screen and starts speaking noticeably louder and clearer right afterward. The second feedback whisper was sent when the other student was presenting. She was instructed to talk slower. Yet again, the whisper was noticed, and the student immediately started talking noticeably slower. The final feedback whisper told the presenting student to leave more space for the other student to take the lead. After the whisper was sent, the student glared at the screen for two seconds and made eye contact with the educator whilst making a nervous gesture with her face. The educator responds with a thumbs up to the presenting student. She steps back from the foreground in the session and makes eye contact with the other presenting student. The other presenting student takes over the session and becomes more active. This indicates that, if used correctly, the whispers can be a huge benefit during the microteaching setting. The students implemented the feedback without any problems, and the session was better for it.

The students did have a good eye for the laptop in front of the class, but still, they were observed not seeing one whisper. It should be realized that it is inevitable in this setting to have the students see all the whispers.

Once, the educator whispered a compliment to students in front of the class. The student who was presenting took one or two seconds to glare at the screen and read the compliment. She was briefly visibly distracted during this timeframe and continued teaching the workshop as she had previously. This was a minor, but noticeable distraction of the student. A question that arises from this is, is it worth it to cause a minor distraction for students who currently are giving a microteaching to compliment them?

8.2.4. Difficulties encountered by students

SQ 4.5: What difficulties do the students encounter whilst using the tool?

When asked what problems they encountered in the feedback process, the students from the experiment group mentioned on the survey that it is difficult to give feedback during a session. One of the students thinks that this might have to do with a learning curve. One student is disappointed that the amount of verbal feedback is reduced, and two students think that the possibility to give feedback is too limited, because of the restrictive nature of the Likert scale, and yes/no feedback criteria. One other student backed this up by denoting that they missed an open text field whilst giving feedback. An open text field possibly allows the feedback to be more directed. The feedback criteria can hardly cover all aspects of the session, and feedback can differ from the predefined criteria.

Some people mention that they do not pay a lot of attention to the tool. This might also be a learning curve that should be investigated further in the future. This learning curve was also mentioned by the educator during both interviews.

One student found the tool to be a bit too much on top of the original class, and one student mentioned that the scrolling on their phone made it difficult to get an overview of the feedback they had to give. This scrolling was also noticed during the expert experiment of section 6.3.1. Three students mentioned on the survey that they would like to have open questions. The educator mentions in the interview that students told her they felt like they were not able to give the feedback that they wanted to give. One student mentioned that they missed the educator feedback. One student thinks that it should take less time in the classroom and one student says that they would prefer a laptop.

8.2.5. Perceived learnings from feedback by students

SQ 4.6: How much do the students feel like they learn from the feedback process?

In the control group, every student voted neutral when asked how much they learned from giving feedback. We conclude from this that they did not gather any additional knowledge from the giving of feedback, even though they had the same criteria to pay attention to as the students using the tool. In the experiment group 60% voted “neutral”, 30% voted “A lot”, and 10% voted “Very little”. The person who voted ”Very little” says that they did not pay a lot of attention to the tool, resulting in this vote. Three out of ten people from the experiment group mentioned that they reflected more because of the tool, and two students mentioned that it was more difficult to follow the activity. This might be because of the active nature of the activity. Even though most students voted “neutral”, there is a positive trend visible, in the different answers given in the control group, and experiment group.

When asked what the students found most helpful during the feedback process, the answers in the experiment group varied. Two students mentioned the fact that the feedback is live, one person mentioned the feedback criteria were a great help, one person found the creation of the summary helpful, one student mentioned the higher quantity of feedback, two people found the fact that the feedback is saved helpful, one person said that talking about the received feedback was the most helpful thing for them, one student mentions that they liked the feedback report, and one student finds the whispers the most helpful part of the feedback system. In the control group, the answers are more aligned. Two answers say “receiving feedback”, and two answers say “Tips”. These are also two things that are given when using the feedback tool. The fact that the students who used the tool did not mention these, but did mention a wide range of other aspects, led us to conclude that the tool has a lot of potential and a wide range of benefits.

8.2.6. Alternative methods of giving feedback

SQ 4.3: Do students feel like there are better alternatives to handle the feedback process?

On the survey, 50% of the class voted yes, and 50% voted no to the question if the tool was the correct tool to give feedback during this session. One of the students who voted no stated that the educator should give more feedback since the students themselves are occupied with the microteaching session. Another student was missing the discussion at the end of the session which was left out due to time constraints. A student mentioned that they did not find it practical to reach for their phone during the session. This student thinks that it decreases engagement when students take their phones

out while a microteaching session is in progress.

Multiple students argued that what the tool did, could also be done through verbal feedback this concern was also voiced by students of the Hogeschool KPZ as mentioned in section 7.4.3.3. Other students argued that they missed a verbal discussion, but did not argue that verbal feedback could replace the tool.

8.2.7. Other findings

One of the encountered problems that was observed, and mentioned by the educator during the interviews, was that the summarizing of feedback by the presenting students took longer than expected. The students who gave feedback did not seem eager to summarize their feedback. Even when they were told to summarize their given feedback they were often passive. We expect that this might be caused by an unclear interface. When the peers did summarize their given feedback, they were done a lot quicker than the students who were presenting. This is likely to be caused by the fact that the presenting students had a lot more feedback to summarize, and the fact that the peers knew which feedback they had given, and thus knew what they had to summarize. Another possible influence in the speed at which the summary could be created by the presenting students is the fact that the researcher brought a laptop for receiving feedback. This laptop had a QWERTY keyboard, while in (partially) French-speaking countries AZERTY keyboards are used often. Some students pointed out having trouble typing on this keyboard.

The waiting time for a summary to be created led to an awkward silence after each session. The educator mentions that students might feel pressured when creating the summary in front of the class. This might be because they do not want to have the class waiting, or because they feel like everyone is looking at them. Because the peers still had to give feedback after the microsession, the presenting students were waiting first. Then when the summaries had to be made, the peers were waiting for most of the time. It might be interesting to let the presenting students start summarizing whilst the peers are not done giving feedback yet.

During the second experiment day, students started discussing the feedback verbally whilst creating the summary. This started with someone having a question about the feedback. This conversation during the creation of the summary killed the silence and turned it into a learning opportunity for the entire class.

Another interesting occurrence during one of the sessions was that a presenting student was having a hard time because the workshop turned out to be too challenging for the peers. The student in front of the class seemed nervous and tried to rush towards the end of the session. When she tried to close the session, the educator interrupted verbally, without using the tool, and suggested trying the exercise with music. The student in front of the class replied verbally and implemented the suggestion. It was beneficial for the microteaching session to do this interruption verbally, and this might indicate that the tool should not dissolve all class interruptions. A hybrid implementation of whispers for minor feedback, and verbal interruptions for major feedback seems beneficial.

The educator mentioned in an interview that during one of the sessions, a student walked back to the laptop and looked at it. She was surprised to see a black screen. She expected to see the whispers that had been sent. The whispers had however already disappeared. The students were told before the class sessions that the whispers disappear after a couple of seconds because they are time-bound,

but it still raises an interesting question, should students be able to see whispers after they have disappeared? Everyone can miss a whisper now and then, and it would make sense to give a student control over these whispers. A student should however not pick up a laptop during a microteaching session, and start browsing whispers to check if they missed any because this will be a major disturbance of the class. A possible alternative is to keep the whispers with a reduced size on screen. This might however be distracting for the presenting student. The effectiveness and necessity of this feature should be investigated further.

A deal-breaking bug was found in the system during the experiments, where one student was not able to summarize the feedback that they had given because there was a mistake in the feedback timeline which kept crashing his page on every load. The educator points out during an interview that technological problems always interrupt the class since they have to be solved before one can continue. It is important to solve all technological issues before the tool can be used properly.

The educator pointed out during an interview that she missed a place for herself to give feedback that should not be whispered to the students. For now, she used a text document to type feedback for the students. She would like to have a place in the system where she can add written feedback. The benefits of this are that all the feedback is in one place, the educator does not have to switch to different applications every time she wants to give feedback, and the feedback can be used by the system. This would mean that the students can once again compare their feedback to the feedback that the educator has given, instead of the whispers.

The educator also mentioned that when there is not much time available for microteaching sessions, the tool can be used to collect a “Treasure of information”. She was positive about the amount of feedback given by the students and mentioned that the students who used the tool improved their workshops a lot more than the students in the control group. She thinks that the tool has the potential to be very valuable for the students in the control group since it will force them to give more feedback.

The educator points out that students do have to be able to give multiple answers during a feedback question. This was also noticed during the previous experiments and discussed in sections 6.3.1 and 7.5, but not implemented because of time constraints. The fact that the educator requests this feature, is another validation that it is indeed required.

8.3. Issues & the way forward

The biggest problem encountered during the sessions was that the presenting students often had no eye for the laptop that displayed the whispers. The educator mentioned during the interviews that there might be a learning curve to the system. She expects that when students use the system more often, and see the value of the whispers, they will actively try to look at the laptop. A learning curve was also pointed out by some students in the survey. This learning curve might be interesting to investigate further in upcoming research.

Students occasionally did not have enough time to give feedback during the microteaching sessions. This resulted in low amounts of feedback being given. Students pointed out on the surveys that they did not like giving feedback on their phones. This highlights again that is interesting to see if this also occurs in microteaching sessions outside of music as was discussed in section 7.5. Students mentioned on the survey that they think this system would fit in other classes. This might allow

laptops to be used for giving feedback, which is something that students requested on the survey.

Currently, the educator can not give any feedback besides whispers in the system. During the experiment, she had to write feedback down in a text document and send it via email to the students which is not ideal. A way for the educator to give general feedback besides whispers should be implemented in the system. It is not clear if the educator should get a notepad in the system where they can leave random feedback, or if they should fill in the criteria like students, or maybe even both. This should be investigated in more depth in future research.

Creating the summary consumed a lot of time, and replaced the verbal discussion during the first experiment day because of time constraints. A verbal discussion was identified as important, and should hardly ever be skipped. It might be interesting to implement the discussion in the creation of a summary, by letting the students create the summary together. Right after the session has ended, all feedback can be shared with all students, and they can use it to discuss. This might be a breach of personal safety since feedback can be personal. However, in verbal discussions, feedback is shared with the class too, and the feedback given throughout the experiments conducted for this thesis was not considered to be harsh, leading us to believe that sharing the feedback among the class is not problematic. When all the feedback is shown to all students, all students can read it and pick topics to discuss. When something is discussed, the students can highlight important points, together with the educator, whilst the presenting student or the educator is typing the summary. It might also be interesting to let the educator create the summary because this frees up the presenter to fully engage in the discussion, whilst it gives the educator control of highlighting important points of improvement for the presenting student.

Students mentioned that they were not always able to give the feedback that they wanted to give, because the feedback criteria restricted them. To avoid this, it might be nice to create an open text field that is always shown during the giving of feedback for general remarks and not tied to any criteria. An educator might need to be able to turn this off in the settings section of a feedback session to avoid undesirable situations.

The system crashed for two students due to a bug in the code. Crashing software will always disrupt the class according to the educator. In the future to avoid having bugs, or crashes in the most important areas, automatic tests should be written in the software. These tests should fully cover the feedback flow, from creating a class session to providing feedback.

9 Technical Implementation

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It might not seem like it when reading this thesis, but the most time-consuming aspect of this research was writing code. To give an insight into how much work was put into this, and to brag a little, here are some statistics.

In total, there were 29 pull requests created, reviewed, and closed by me. A total of 365 commits were made to the GitHub repository, which at this moment consists of 13004 lines of clean code written by me. This number excludes generated code, external packages, and images. To put this number in perspective, a page in this thesis with just text, so no line breaks or headers consists of 57 lines. This means that if you fill the 210 pages that this document consists of, and fill it with text at font size 11, you would still have fewer lines than the codebase contains. during the creation of this tool but replaced or refactored due to the agile nature of working in this iterative approach.

This next chapter dives deeper into the technical decisions that have been made during this project. It is expected that the reader has experience with software development, and has knowledge of different popular JavaScript frameworks, and software development terminology.

9.1. Development stack

Meteor.js was picked as the main framework on which the application was built. Meteor is an open-source platform for building web, mobile, and desktop apps. It provides a lightweight API with front-end implementation. The developer does not have to worry about requests and call functions in the API directly from the front end. Meteor then creates the request and sends it to the API. This means that for the developer, the API and front end feel like a singular application. It is also developed in a mono-repository style, meaning that the API and the front end live in the same space. This speeds up development time since no switching between projects is required. This also means that code can be shared between the API and front end.

The main reason why Meteor was picked, is because it handles data in real time. This means that once data in the database gets updated, it gets updated on all clients that are currently connected. This is great for an in-action feedback system since one does not have to worry about sending feedback. It only has to be saved in the database, and all the clients that are subscribed to that data will immediately retrieve it. Real-time data is often a tricky part of software, but Meteor simplifies the handling of it significantly.

MongoDB is the default database shipped with MeteorJS and is used for this project. This is a document database, meaning that unlike the more popular options, like MySQL, MongoDB does not have strict structures or type rules. This means that the database design can be simpler. It does however come with the risk of getting messy when implementations are not well thought out.

Meteor.js has front-end aspects, so it can not be implemented with all front-end frameworks. It currently has support for React, Vue.Js, Svelte, BlazeJs, SolidJs, and AngularJs. React was chosen for this project since this is the framework that most meteor documentation is based on. Development with Meteor and React has also been done previously by me when developing a planning tool for Unicarrier engineers, and several other projects. This previous experience helps the development of this project.

Meteor and React can be used with TypeScript, but it was chosen to use vanilla JavaScript for this

project. This was done because of the prototype nature that the project started as, and TypeScript is more time-consuming to write in the short run. To get some TypeScript advantages in JavaScript, type checking on the component level should be introduced when the system is developed further. This can be done by using the React-specific “prop-types” NPM package.

Styled components are used for styling. This mostly avoids the use of CSS classes, which often get messy with bigger projects. Only a small required base of styling is global, like the alerts, anchors, buttons, containers, form elements, page wrappers, windows, and other components that are used in multiple places. All other custom styling is done at the top of the files of the React components. This does make the files longer but does not increase the complexity, since the logic is still in the same place. This means that a developer needs to have fewer files open, and always knows where to find their styling, speeding up and simplifying the development experience. This also avoids discussions about where to put which elements which often take place when implementing methodologies like atomic design. Styled components use CSS in JS, which means that all CSS is written in JavaScript strings. This allows for more logic to be implemented into the CSS. An example of code in a modular component that calculates the height in percentages of an element to fit all the items through a

```
border-radius: ${spacing.sm};
height: ${({items, maxItems}) => items * (100 / maxItems)}%;
display: flex;
```

Figure 9.1. Code that calculates the height that a component should be based on the maximum amount of items that are allowed to be displayed.

combination of CSS and JavaScript is shown in Figure 9.1.
GitHub is used for version control. Because only one person is working on this project, the researcher conducted his own code reviews. These were swift and acted as a last resort to detect simple mistakes, typos, and code that was forgotten to be cleaned up. For every story that is picked up, a new branch was created with the name of this story.

No testing software was used. Instead manual interface tests were done on every branch before they were merged to the main GitHub branch to ensure that the tool worked as described in the user story. Before every experiment, a manual test of the entire feedback flow was conducted to ensure that the tool was working properly. No automated tests were created because of the time constraints of this thesis. However, during the experiment in Leuven students experienced crashes due to a bug as discussed in section 8.3. This highlighted the requirement of automated tests. These tests will be considered for the main feedback flow and the API security.

A challenge that might occur when creating these automatic tests, is the fact that multiple users are required for the feedback flow, which is difficult to simulate in a test. This can be overcome by mutating data between steps, this will mean that the tests are vulnerable to changes in the data structure. Implementing the tests should be well thought out to make it sustainable. When tests are not written properly, they usually cost more time than they save. When they are written correctly, they can save precious development time, and ensure a working experience for the end users.

9.2. Package list

In order to reduce dependency on other developers, and reduce the bundle size, a minimal amount of packages were used for this project. Two package managers are used, Node Package Manager (NPM) for the front-end and Meteor's own package manager for the backend. This is a list of all packages, and what they are used for. Some of the functionalities for the NPM extensions use multiple packages to achieve the singular goal described. This is why all packages are listed with their functionality.

Development environment (NPM package)

"@babel/runtime": "^7.17.9", "meteor-node-stubs": "^1.2.1",

These packages are installed during all fresh Meteor installments, and provide a node-like environment on the client, in which most packages can be used. Meteor node stubs is a replacement for Browserify, or Webpack but made for Meteor.

Emotions styled components (NPM package)

"@emotion/core": "^11.0.0", "@emotion/react": "^11.11.1", "@emotion/styled": "^11.11.0"

This is used for all styling in the application. Styled components offer a clean way of structuring the styles like described in the section 9.1.

Fontawesome (NPM package)

"@fortawesome/fontawesome-svg-core": "^6.4.2", "@fortawesome/free-regular-svg-icons": "^6.4.2", "@fortawesome/free-solid-svg-icons": "^6.4.2", "@fortawesome/react-fontawesome": "^0.2.0"

Fontawesome is used for all icons displayed on the platform. It reduces design time significantly, since icons do not have to be designed individually, but can be taken from a library instead.

I18next (NPM package)

"i18next": "^23.7.16", "react-i18next": "^14.0.0",

This allows the platform to be bi-langual. In the future, more languages can be added easily if deemed necessary.

React (NPM package)

"react": "^17.0.2", "react-dom": "^17.0.2"

React is used for creating the front-end. It offers a reactive component based development experience. It is often referred to as a framework, but is actually a library.

React router (NPM package)

"react-router": "^6.16.0", "react-router-dom": "^6.16.0",

React does not offer routing by default, this is why react router is used for routing on the platform.

React transition group (NPM package)

"react-transition-group": "^4.4.5"

React transition group lets developers animate data when it changes. This allows for animations being played when new content is added or removed.

Use debounce (NPM package)

"use-debounce": "^9.0.4"

When someone is typing feedback, it will only send it after they've stopped typing for one second. That is done using a debounce to improve performance.

Dependency-cruiser (NPM package)

"dependency-cruiser": "^16.3.2"

This was used to generate class diagrams, because of the size of the application, it is challenging to create a handmade class diagram. This package is a devDependency.

Accounts-base (Meteor package)

Offers limited login functionality, this is used to handle all authorization, and creation of accounts.

Accounts-password (Meteor package)

The default accounts base does not come with a password login. This package adds the possibility to login using a password.

Montiapm:agent (Meteor packages)

Offers better performance monitoring through the Monti APM web platform.

9.3. Project structure

All Meteor applications use the same root folder structure, which is not altered during this project. It consists of the following folders in alphabetical order:

- **Client**
  This folder only holds two files, main.html which is the html file where the react application will be rendered. It contains the head tag which defines the view port and loads the fonts, and provides one div in the body which is used as a target by react. The other file is main.jsx. This file mounts the react application to the html file. It does not include any logic, besides some font configuration for the body, headers, and buttons through CSS. Also the CSS property "box-sizing: border-box" is added to every element in the application.
- **Imports**
  This folder includes most code. It is used for all files that are imported for both the API, and the user interface.
- **Public**
  This folder is published to each client, and is only used for storing images in this project.
- **Server**
  This folder contains only one file which runs once on the server when the server starts up. It creates the database indexes, and imports all the API components, so that they are run on the server.
- **Tests**
  This folder was not used during this project, but Meteor creates a test folder by default with a couple of default tests. In the future, the tests for the main feedback flow will live here.

Upcoming subsections 9.3.1, and 9.3.2 only talk about the public folder, since this is where all code for the application lives. A class diagram of the public folder can be found by opening the link in Appendix AE.

9.3.1. API

The API folder in the imports folder contains two subfolders, collections and subscribers. MongoDB uses collections to store data. Each collection has its file in the collections. The filename is equal to the name of the collection. In each collection file, a Mongo collection is defined and exported. This can be done with the code shown in Figure 9.2. These files also contain the so-called Meteor Methods. These would in a traditional API be endpoints for POST and PUT requests. In Meteor, they function like methods that can be called asynchronously from the front end instead. An example of a meteor message for creating a class is shown in Figure 9.3. In this method, it is first checked if the user has the educator role, then a check is done that checks if the name is filled in, and is a string. It will assert the code, and give an error on a mismatch. Then with the Classes. insert command, the class is inserted in the previously created classes collection, shown in Figure 9.2.

```
1+ usages  midasminnegal
export const Classes = new Mongo.Collection('classes');
```

Figure 9.2. A collection for the classes which students can join is initialized

```
'class.create'({name}) {
  if(!userHasRole('educator')) {
    throw new Meteor.Error('not-authorized')
  }

  check(name, NonEmptyString)

  return Classes.insert({
    name,
    students: [],
    educators: []
  })
}
}
```

Figure 9.3. A meteor method which creates a class into the database

```
midasminnegal
Meteor.publish('feedbackThatHasUnreadComments', () => {
  const userId : string  = Meteor.userId()

  return Feedback.find({
    feedback: {$elemMatch: {hasReadComments: {$nin: [userId]}}},
    $or: [
      {receiverIds: userId},
      {authorId: userId}
    ]
  })
})
```

Figure 9.4. Code of a Meteor subscriber responsible for getting all the feedback that has unread comments

As previously mentioned, the GET requests are not handled through meteor methods. A traditional GET request would not allow for responsive data, since the request would have to be executed every time the data changes. This is why Meteor offers subscribers. These subscribers are found in the subscriber subfolder and are just like the collections named after the collection that they are responsible for. Meteor caches data in a local database which is a copy of the original database called Mini Mongo. The subscribers decide which information is written to this local database. An example of a subscriber is shown in Figure 9.4. First, the userId is obtained. This is not sent as a parameter but received from the server so that malicious users can not spoof their userId. Then a MongoDB search is done to query all feedback that does not ($nin stands for not in) have the userId added to the array of people who have read the comments. It is also checked if the user is a receiver or author of the comment. This data is returned, meaning that it is being added to the Mini Mongo local database, and thus published to the client. Whenever the data gets updated, the clients will automatically get the newest data.

9.3.2. User interface

A UI folder is present in the imports folder. It includes four subfolders, namely Components, where all the react components live, Pages, where all the parent components live for the pages, Styles, where all the globally styled components live, and utils, where all the utilities live that are used throughout the

components. Besides these folders, there is also a file in this folder called Root.js which handles the routing of the application. The components and the pages folders contain all complex logic and will be discussed further in this section. Since the front end is mostly a regular React application, only the structure and Meteor integration will be discussed in this subsection.

In the Components folder, there are subfolders for every component, since some components might have variations. The default component is named index.js inside this folder. Some components like the NavBar, for example, consist of multiple JavaScript files. For the navbar, they are called index.js, ChatDropdown.js, ChatdropdownItem.js, and ActiveClassSessionNotification.js. These components are all used in the index.js and nowhere else. This approach means that the complexity of the NavBar can be broken down into multiple files and that these files do not clutter the list of components since they are contained in the navbar folder. The main parent components are called index.js, because this lets React know that it is the main file, meaning that the Navbar can be imported from “components/navbar” maintaining a clean import style.

Components are often responsible for calling Meteor methods when they have to conduct a PUT or POST request. An example of a function that creates a feedback set is shown in Figure 9.5. First, it is checked if the data is filled in to create a feedback set. If this is not the case, the function returns false, and the set will not be created. This “canCreateFeedbackSet” method is also used in the front end to show the user that not all data is filled in. This merely serves as a double-check to avoid malicious uses. Then it filters the criteria to ensure that no empty criteria are being added. Finally the ‘feedbackSet.create’ meteor method is called via the Meteor.call function. Whenever the method is finished, a callback function is called. When an error is found, this error is shown to the user in the front end via the setError method. Else, the form is cleared, and the modal is closed.

```
const createFeedbackSet = () : boolean | undefined  => {
  if(!canCreateFeedbackSet()) return false;

  const filteredFeedbackData : ({...})[]  = feedbackCriteria.filter(({inactive, question}) => !inactive && Boolean(question))

  Meteor.call('feedbackSet.create', {
    name,
    feedbackCriteria: filteredFeedbackData
  }, (err) : void  => {
    if(err) {
      setError(err.message)
    } else {
      setName('')
      setError('')
      setFeedbackCriteria([{}])

      setIsOpen(false)
    }
  })
```

Figure 9.5. A method in the front-end that tells the api to create a feedback set

All pages have their file in the Page folder. These files contain the base of the page and are in general responsible for fetching the data from the API. An example of how this data is being fetched is shown in Figure 9.6. First, all the subscribers are called via the Meteor.subscribe function. These subscribers get all the data as described in section 9.3.1, and write it to a local Mini Mongo database. Meteor subscribe returns an object that allows the monitoring of the progress of the requests. This is how we can return a loading variable, which will return false when all the subscribers have the “ready” state. Under the loading parameter, database queries are executed in the front end. These queries are run on the local database, so they are not a security risk since this database only contains the data that has previously been subscribed to.

```
1+ usages  midasminnegal
export default withTracker(props => {
  const handleFeedbackSets : any | SubscriptionHandle  = Meteor.subscribe('feedbackSetList')
  const handleUser : any | SubscriptionHandle  = Meteor.subscribe('userList');
  const handleClasses : any | SubscriptionHandle  = Meteor.subscribe('classList')
  const handleClassSessions : any | SubscriptionHandle  = Meteor.subscribe('classSessionsForLoggedInUser')
  const uid : string  = Meteor.userId()

  return {
    loading: !(
      handleUser.ready() &&
      handleClasses.ready() &&
      handleClassSessions.ready() &&
      handleFeedbackSets.ready()
    ),
    user: Meteor.users.findOne({_id: uid}),
    feedbackSets: FeedbackSets.find({educators: uid}).fetch(),
    students: Meteor.users.find({profile: {roles: ['student']}}).fetch(),
    classes: Classes.find({}).fetch(),
    classSessions: ClassSession.find({}, {limit: AMOUNT_OF_CLASS_SESSIONS_HOME_PAGE}).fetch(),
  }
})(Home)
```

Figure 9.6. The data that is being fetched on the bottom of the homepage file

The data returned in the withTracker function is passed as a prop to the page component. These props act like they are in the React state, meaning that they force a re-render whenever they change. This simplifies the implementation of reactive data but means that rerenders occur more frequently than on normal websites. This is however not seen to give any problems during this thesis

9.4. Deploying to Digital Ocean

9.4.1. Hosting

Digital Ocean offers a high variety of hosting plans, ranging from $4 to thousands of dollars a month. They offer $200 of starting credits which can be used in the first two months. This gave the possibility to experiment with which plan is required for this tool to function correctly. Digital Ocean

does not have native Meteor support, which means that time had to be invested into setting up a custom deployment process first. This process is discussed in more detail in section 9.4.2. After this deployment was set up, multiple DigitalOcean plans were tested. The cheapest $4 plan with 512 MiB memory and one vCPU crashed after trying to deploy for a couple of hours. The deployment worked fine however on a $56 a month plan with 8 GiB memory and 4vCPUs, which was the most expensive plan we could switch to without asking permission from Digital Ocean. To see if the problem was resolved, the same load test as in subsection 7.2.3. was conducted with the new DigitalOcean hosting, and one more iPad as shown in Figure 9.7. With this $56 plan, under the highest load, we could create with the 16 iPads, the 4 vCPU cores did not break a sweat, and the CPU usage charts did not exceed 7%.

Figure 9.7. A load test with the system, with the DigitalOcean dashboard in the background

A plan that costs $56 a month is unfortunately not sustainable after the $200 free credits have expired, so further tests with cheaper plans were conducted. DigitalOcean offers “Premium Intel”, and “Premium AMD” packages. The CPU is still listed as one vCPU for the cheapest plans, like in the $4 package which did not work, and there is no further information available on what the difference is between these plans. The assumption can be made however that this is a newer, or higher-end processor than on the regular package. Both the cheapest premium Intel and premium AMD packages were tested, costing $8 and $7 a month respectively. The AMD package uses more CPU whilst idle, however, under the load of 32 accounts giving feedback at once, they performed identically and peaked at around 25% CPU usage. All accounts worked as they should, and no delay was noticed during the entirety of the stress test.

The premium Intel and AMD packages seem to perform identically under 25% load. An experiment highlighted in a blog by k. Kumawat (2021) however found that the AMD packages outperformed the Intel packages significantly when under heavy load. His research focussed on WordPress sites but also included benchmark results from GeekBench. This blog, and the $1 a month price difference, make the Premium AMD package with one GiB of memory and one vCPU, costing $7 per month a suitable choice for this project.

9.4.2. Deploy setup

Deploying should be easy and quick. For this project, the 'npm run deploy' command was created which will handle the entire deployment for the user. It executes the "mup deploy --config=.deploy/mup.js --settings=settings.json" command, where the --config is the configuration for Meteor up, --settings is the meteor settings. Both these files contain authentication data, so they are not pushed to git, but example files without sensitive data are on git. Meteor up is the tool that is currently being used for the deployments. Because a deployment can be done by only running one singular npm command, it can easily be integrated into future pipelines so that deployments can happen automatically when a request is merged to the main branch. When this is done, the entire deployment process can be handled via Git. It is however advised when this is done to have a separate development branch, that deploys to a development server which is used for testing purposes. Pull requests should be merged into the development branch, and when it is tested, the development branch can be merged into the main branch.

The DigitalOcean server runs two different Docker containers. One is a virtual machine that runs the meteor server, and one runs the MongoDB database. zodern/meteor:root is the image used in the deployment process. This image sets up both docker containers.

9.5. Known vulnerabilities

In its current state, the developed tool would not be able to be used in real practices. Because the tool is developed as a prototype, not all security measures were taken in the API. The front end itself does not lend itself to malicious intents, but the API is not airtight. When one can fabricate their requests, they are currently able to execute requests they should not have access to. The API does always check if the user is logged in and has the correct role, but it does not check if, for example, the user is part of a session. This means that malicious students are not able to start, stop, or manipulate sessions, but they can give feedback to class sessions they are not part of if they have the ID of this session, and know how to fabricate requests. The API does use type checking, so people should not be able to inject wrongly typed data into the database.

The system uses a subscriber called "usersById", to which students do have access. This means that students if they have the user ID of other students, can retrieve their data. Passwords are encrypted, but email addresses will be leaked. The system is not likely to be hacked in the first years during light use, but vulnerabilities exist, which should be removed. During the experiments conducted in this paper, all accounts were provided to the participants. This means that there has been no risk of leaking personal participant information.

The biggest security vulnerability currently in the system is that the user roles are stored in the "profile" field of the user. This was done during development since this is the only writable field of

the user object. It was discovered later that this field is not protected, so a user can change it if they can fabricate the correct API request. This means that currently, all students can give themselves the “educator” role, and become an educator in the system. This should be fixed before going live and can be fixed by using the well-maintained meteor-roles community package. This however is a big alteration to the system. All accounts will lose their roles which will have to be added again. This, together with the big security risk, is why it is essential to fix this before the platform goes live.

10

11

Discussion, The Future & Conclusion

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10. Discussion

The initial aim of this thesis was to design an interactive experience that enhances musical classes at PABOs. It was noticed that peers are not as involved in the didactic process during microteaching sessions as the student who leads the session. Through vicarious learning, peer feedback was identified as a potentially valuable asset in involving these students more in this process. This is why a digital peer feedback system was designed to let students more actively reflect on the didactic side of a microteaching that is being given. We expect this research to apply to every institution that uses musical microteaching and we expect that this research might even apply to microteaching in general.

10.1. The designed peer feedback system

To better involve the students in the didactic process of a microteaching session, we use something we call in-action feedback, which is giving feedback during an activity. The requirement for students to give feedback whilst following a microteaching session requires them to actively reflect on how the session is being taught during this activity. Some students noticed this effect during the experiment as discussed in sections 7.4.3.4 and 8.2.5. We also expect the quality of feedback given to be higher when it is given in-action because the memory is still fresh as discussed in section 5.2.3.

The system uses feedback criteria to structure the feedback towards the desired direction. These are questions or statements the educator defines that the students have to give feedback on. Because these criteria are created by the educator, they can be tailored to the context of the microteaching sessions. Students mentioned during both in-class experiments conducted for this thesis that these criteria helped them structure, and give feedback as discussed in sections 7.4.3.4 and 8.2.5.

Because feedback is given in-action, it can be delivered immediately to the presenting student. This was identified as valuable in section 5.2.1 because it allows the student to immediately alter their microteaching session when they are making a mistake. During the expert experiment, it was highlighted that receiving high quantities of feedback while leading a microteaching session might be problematic for the presenting student because there is no time to read the feedback (section 6.3.2). This is why the educator is placed in a moderator role, where they receive all the feedback and can forward the important feedback to the presenting students. We call this forwarded feedback a “whisper”. These whispers were identified as very effective when the student sees them as discussed in section 8.2.3. Students did however not always have an eye for the whispers when giving their microteaching sessions as discussed in more detail in section 10.2.

While designing a lesson for the feedback tool in section 7.3, it became clear that music lessons consist of separate activities that can require different feedback criteria. This is why the ability to hide or show feedback criteria before, and during feedback sessions was added. This made the tool more versatile. In section 6.4 it was discussed that open feedback criteria should be used after microteaching sessions whilst selectable feedback criteria should be used during the sessions. This feature allows for this principle and was successfully implemented in the in-class experiments in chapters 7 and 8.

10.2. Challenges of implementing a peer feedback system in a musical microteaching

Implementing technology into musical microteaching comes with multiple challenges. This section does not provide an overview of all the challenges encountered during the thesis, instead, a collection of the most important challenges was picked to discuss in more depth.

Students are active during musical microteaching sessions. This means that there is limited time available for them to give feedback. The system was optimized to give feedback as quickly as possible, but giving feedback still requires a moment in which the peers are unable to participate in the microteaching. During the final experiment, students got extra time at the end of each microteaching to finish their feedback, since they were not able to fill in all their thoughts. This led to more time spent on the tool as initially intended, but a significant increase in the amount of feedback given compared to a verbal feedback discussion. It would be interesting to see if this lack of time to give feedback also occurs in other microteaching classes besides musical ones. This was also proposed by students from the in-class experiments. Musical microteaching is a worst-case scenario for such a system because of its active nature. That the system even functioned in this context shows the potential it has to add value, even when it has to overcome challenges.

Quality feedback implements context to be constructive. This means that feedback has to be tailored toward the specific situation, which can be a time-consuming process. Rubrics of one, Likert scale, and multiple choice questions hardly ever provide this tailored information but are quick to fill in, whilst open questions do offer this tailoring, especially when filled in by more experienced students.

Introducing technology into the classroom tends to cause distractions. This was also the case when introducing the feedback tool. Distractions were especially present during the first class experiment at Hogeschool KPZ in Zwolle. It was found that it is of utmost importance that students do not have to wait for the system to load. During the in-class experiments at LUCA School of Arts in Leuven, the distractions were a lot less, and the educator did not consider the technology to be distracting. Only 20% of the participants voted that the technology was disruptive during the in-class experiment. It should be taken into consideration that some students are more easily distracted by technology than others.

An encountered problem with the feedback whispers discussed in section 8.2.3 was that students do not always see them. An educator can resend the whispers if a student does not see them, but an educator can not know if a student has read the whisper. This leads to the question, should the past whispers remain on the screen, or is this too much of a distraction for the students? Do students need to be able to browse the feedback during a session, or is this not feasible? There might be other solutions as well to this problem. Future research is required to find, and validate a fitting solution.

Giving feedback on a phone was discovered to be challenging in chapters 7 and 8. A phone is likely in the student's pocket during the session and has to be gotten out and unlocked before a student can give feedback. This was noticed to cause some disruptions in the class. The application is less user-friendly on a phone, than it is on another device because of the small screen size. It might be interesting to test the tool on other devices than a phone in the future. This was also pointed out by students on surveys during both experiments and we expect that it will increase the amount of

feedback given and decrease the distractions caused in the class. Other devices like laptops might however come with their own distracting, or disruptive properties, which should be looked into in future research.

10.3. Value of the feedback system

A characteristic of microteaching is that one student is presenting whilst the rest of the class is following the session. This means that a student is only a small part of the time the teaching student. Often students can not implement the feedback that they've gotten into microteaching, since they only have one opportunity to give the microteaching. By using whispers, the presenting students can implement the feedback that they get immediately into the same microteaching as discussed in section 8.2.3. It is expected that once a class becomes more familiar with the system, it will use the system more optimally. This potential learning curve was also pointed out by students on the survey, and by the educator in chapter 8. During the experiment conducted in this chapter, whispers often were not visible because students positioned themselves in places where the laptop was out of their sight. The educator who taught this class thinks the students will position themselves in sight of the laptop on purpose when they get more familiar with the system and are aware of the value whispers can have.

Students are challenged to more actively think about how a lesson is taught. This thesis was not able to prove this statistically, but all students were actively giving feedback during both experiments, leading us to conclude that all students were challenged with thinking about the didactic process. In section 5.2.5 it was mentioned that an educator thinks that some students are lazy, and hide away when feedback moments occur to let other students do the work, which no longer goes unnoticed with this system.

This involvement of all students in the feedback process means that more feedback is given than during a regular session. The educator of the last experiment called it "A treasure of information" as discussed in section 8.2.7. On average, there were 40 answers given to feedback criteria per session, with a highest count of 78, and a lowest of 22. This was with limited class sizes of five to ten people. A traditional peer feedback discussion is not expected to be able to extrapolate this much information in this limited amount of time. All feedback is stored on the system, meaning that the student has an overview of all the feedback that they have received during the session accessible at any time, which is important because feedback is often forgotten by students as discussed in section 5.2.5.

An upside of the system that has not been discussed previously since it has no significant scientific addition but does add value to the system, is that it can be used on devices that are already present in the classroom without any installation required. This means that the educator only has to load up the website and instruct the students to log in on it for a session to start.

10.4. Future research & improvements

Different potential improvements and research directions have been discovered during this research. One example is, what is the impact of compliments through whispers? Receiving a compliment is always nice, and compliments play an essential part in the learning process through positive reinforcement. It was discussed in section 8.2.3 that a compliment can distract a student during

the feedback process, meaning that one can ask oneself, is it worth the distraction to whisper compliments during musical microteaching sessions? Answering this question is expected to highlight the effectiveness of compliments during a feedback session, and the distractions caused by reading a whisper.

Classes were split into two groups and performed microteaching sessions simultaneously during the final experiment because of time constraints. This situation was used to create a control group that was not guided in the feedback process by the educator. The educator recorded these sessions and noticed that the quality of feedback was low. The sessions were generally of lower quality than in the research group, but hardly any feedback was given. The educator also noticed that this group had changed the fewest elements in the workshop since the microteaching. She thinks the feedback tool can improve this feedback since students get a framework to give feedback in. This might be an interesting concept to research in the future, where unguided groups of students use the feedback tool without an educator to enhance the feedback process.

During all experiments, the feature to give multiple answers per feedback criteria was requested as discussed in sections 6.3.1, 7.5, and 8.2.7. This was not implemented because this will require an overhaul of the system which was not feasible within the time constraints of this thesis. However, we do not deny the possible effectiveness of this feature, and this feature should be implemented in the near future. Further research might be required to test how this could be implemented effectively. Some current questions are, is this also required for Likert, and rubric of one questions? Someone does not disagree and agree simultaneously on one question. The use case for this is to show the progression on the timeline, where a presenter can see that first someone voted “disagree”, and then they changed it to “agree” to indicate progression as discussed in section 6.3.1. This can however be problematic when someone accidentally selects a wrong answer. This means that they should be able to edit previously given feedback. This would add complexity, turning the feedback form into a feedback wizard. This added complexity might be especially challenging for mobile users, which is why the implementation of this feature requires further research.

Some students did not feel like they were able to give the feedback that they wanted to give because of the restrictive nature of having feedback criteria as mentioned in section 8.3. An open text field where the students can type general feedback might be a nice addition to the feedback experience. Future research should point out if the students have time during the sessions to put something meaningful in these text fields.

Multiple students and the educator have pointed out during the experiment of chapter 8 that there might be a learning curve to the platform. They expect that the platform will perform better as students get familiar with it. Students will get more comfortable giving feedback and learn to position themselves to see incoming whispers. We think that long-time studies are required to investigate the effects of learning the system. Long-time studies will also allow the research to focus on optimizing reflection on received feedback which is not researched in this thesis. A possible enhancement to the system that helps reflect on feedback might be the use of video, which was proposed during the expert experiment in section 6.4. Video recordings can be made of the microteaching sessions, giving the possibility to tie feedback directly to the moment in the video. This is a similar approach to what IRIS Connect takes. This was out of scope for this thesis, since it mostly focuses on reflecting on the feedback instead of the in-class experience. We however think that it has the potential to be an improvement to the tool.

The experiment conducted in design phase three included a breakout element where students split up into groups and performed microteaching with each other. This seems to be a more time-efficient way of conducting microteaching sessions in a class since multiple students get to be the teaching students simultaneously. Unfortunately, the system does not currently support this breaking out of classes into multiple small classes, meaning that the system can not be used in this context. We expect the system to be as viable in this context, as in a full-class context, meaning that including this feature would increase the number of cases that the tool can be used in.
Different potential improvements and research directions have been discovered during this research. One example is, what is the impact of compliments through whispers? Receiving a compliment is always nice, and compliments play an essential part in the learning process through positive reinforcement. It was discussed in section 8.2.3 that a compliment can distract a student during the feedback process, meaning that one can ask oneself, is it worth the distraction to whisper compliments during musical microteaching sessions? Answering this question is expected to highlight the effectiveness of compliments during a feedback session, and the distractions caused by reading a whisper.

11. From Academic Research To The Class

This thesis took place in an academic research context. Interviewees pointed out that they were interested in having such a tool in the real-world context instead. This is why we, as in one graduation supervisor of this project together with me, are currently exploring possible ways to turn this system into a feasible product that can be used in real classes. This is also the reason why a hi-fi prototype was used during all experiments. A working lo-fi prototype (Appendix AF) was developed and shown to the interviewees during the initial design phase. The interviewees were positive overall, but one of them mentioned that the design was subpar. The prototype was not supposed to look good, because it would just be used for testing purposes, so as long as the interface was clear, it served its purpose. The tool might however have different purposes besides just testing.

This is why over a month was spent on completely redesigning the tool, into a new, professionally-looking product (Appendix AG). Different colors were used, and new functionalities which are not required for this thesis were added, like bilinguality, the possibility to customize your background, and more. During this process meetings with the graduation supervisor were held to discuss what is important for the tool, and what is required to put it in real classes. A lot of ideas were discussed, and we decided to try and get this product on the market as a team. He is now implementing this tool in his PhD research too, hence the KPZ study from design phase three.

We are no marketing experts. I'm a software designer and developer. The graduation supervisor is an educator and musicologist. This is why we followed a course at NovelT, where we were challenged to more actively think about the financial potential and economic challenges of getting such a tool in classes. This led to a couple of valuable lessons, thinking more actively in a LEAN approach about the feasibility of the product. It ended with both of us pitching the concept, and getting valuable feedback.

Currently, we are working on getting more exposure. Ideas are on the table and currently in motion, and a landing page is being developed which will soon be available on our domain name, www.edufade.com. On this site, educators will be able to apply for the product in a free research-focused role.

There still are some technical challenges ahead of us before we can publish this tool in the class. A connection between school accounts and the feedback tool accounts needs to be made. Educational institutions need to be able to have their own spaces with their classes and accounts, and the security issues need to be addressed as soon as possible. A thorough test should be conducted, and bugs should be fixed. For now, we have a Trello board that contains a list of things that still need to be done, but I'm sure that we can do this.

12. Conclusion

In this thesis research was done to develop, and test an in-action peer feedback system. An iterative approach was taken with four design phases, of which one was a research phase and the rest were experiment phases. One experiment was conducted with a group of musical experts who did a microteaching session in the role of students. Two experiments were conducted with a total of seven real music classes in the Netherlands and Belgium. Each design phase highlighted new problems and proposed solutions. These solutions were tested and validated in the next design phase of this thesis. This iterative development cycle improved the platform over time. The role of the educator was transformed from giving feedback to moderating feedback and sending it to the student in front of the class when required. The issue of technology being disruptive in classes was highlighted and suggestions were made to make it less disruptive. During the final experiments, most disruptions of the tool in the class were gone according to the students and educator.

Partaking in a feedback process during an active musical microteaching session is challenging, not only for the person giving feedback but also for the person receiving it. A learning curve that should be investigated in future research might exist. This thesis is the first research conducted on this tool and merely serves as a stepping stone for future research. Multiple areas of improvement and opportunities for alternative uses of the system have been highlighted in this thesis. The system shows potential to be a viable addition to music education, and in the future efforts will be made to bring the system to real classes.

One-sentence answer to the main research question

How to design a tool for in-music class feedback during micro teachings that enhances learning for users using interaction technology?

An in-action peer feedback system that can be used on all devices whilst requiring a minimal amount of actions to give feedback in various ways and allowing the educator to select what feedback is being shown to the receiver in real-time.

Product Video

https://www.youtube.com/watch?v=NpSBKnrLDJw

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Appendix A - Interview primary school teacher

How long have you been a primary school teacher?
For 24 years
Which class do you teach?
Group 4 (Dutch primary school)
What type of music classes do you give the pupils? How are they usually structured?
Her partner gives these lessons, but in the past she sang a lot. Children learned how to sing. Together or individually, when singing individually one sings a solo. Is intens for the children, it is okay if they do not want to. When a child is playing an instrument, it is stimulated that a child takes this instrument to school and tells something about it, and also plays a little, children like this. Stimulates others to think about playing an instrument. The school also has instruments, keyboards, castagnettes, xylofoon, triangles, and basins in a big closet. Multiple instruments are present. They are regularly used, and children like this. Reading the rhythm of notes is also teached.
Do you feel like these classes have an impact on the development of the children?
It varies a lot, some children love it, some children see it more as a “mess-about class”. The older children mainly mess about. From group 7 or 8. A child that needs to stand in front of the class to sing is a very learnable experience for a child. When they have done it, they have achieved something. Music connects. Creating something nice together. Often when there is a show, there is music or dance. A child which is not very good at math or language can show himself as good at something like music. What you see sometimes is the silent kid in the class who gets off the ground when they make music in the class.
Do you feel comfortable giving these classes?
Yes, she likes it.
Do you have a musical background?
She had a general music class when she was 8 years old. Then she had 1 year of lessons in the flute, when she was 10 she started playing the piano until she was 18. She had played in a band and had played in a choir for years.
Do you feel like the PABO gave you a solid foundation for giving these classes?
No, she can not even remember what the lessons were. The only thing she remembered was that she had to sing in front of the class. That is the only thing that she remembers, it was one module, about 8 lessons. She thinks this is too little. People without a musical background have way more trouble giving these musical lessons. Her colleagues dislike it and usually don’t go any further than singing a song in class for the lesson.
What skills do you use most primarily when giving music classes? (Musical skills, teaching skills)
Singing, explanation, mimic, expression, loudness, rhythm
Do you use any method for the music classes?
The method used is “Muziek moet je doen”, this is a showing method which visualizes music. It uses a cd. A lot is also acquired from the internet, for example the current theme is planets. They find music on youtube and use movements which implement this. She uses energizers in the class, these are short moments in between lessons, which is fun. This can be a rhythmical game for example, or sing a traditional song. She gets the themes from “School TV”.

Appendix B - Interview primary school teacher

How long have you been a primary school teacher?
Since the start of the school year. Also some internships since 2017. She starts with graduation after summer break.
Which class do you teach?
Group 3 (Dutch primary school).
What type of music classes do you give the pupils? How are they usually structured?
They have someone from the art academy who is a graduated music teacher who gives 1 time a week. This is to take away work pressure from teachers. Teachers do not like it, so they do not give it or forget to give it. The lessons are more serious and are interpreted better.
She did a song, she took her ukulele to play with them. With the young children (group 2, 3) with a game, so that they could create something with the content of the song. Sometimes she only played, and sometimes the children sang along.
Do you feel like these classes have an impact on the development of the children?
Yes. She thinks that it is not given enough (1 time a week). When the teacher is ill, it is skipped. Children are happier when they have music classes. It has a positive influence on the way children feel and out themselves. They listen better. On friday they are often tired, she puts on songs and they are all happy again.
Do you feel comfortable giving these classes?
She does. She knows a lot of fellow students do not feel comfortable. She knows she is not the best singer, but she says you have to get over it because the kids will not mind.
Do you have a musical background?
She has played guitar from her 8th to 11. She kept playing a little. Now she has her ukelele and she still plays sometimes. Her family is musical as well.
Do you feel like the PABO gave you a solid foundation for giving these classes?
No, she has 1 music teacher who tries really hard to make people enthusiastic, but one teacher is not enough to do this. It is given in the first and second class. In the fourth year you can choose to pick music, but mostly only musically people take this as an extra course.
In the first year it was very general for the younger child (1 to 4). Teacher would teach basic musical skills. Not every session was based on the musical skills, but energizers as well. Then in the second year she was teached how to give the actual classes. She finds that she had too few lessons.In total there were about 5 lessons per module (scheduled bi-weekly), but they were skipped a lot due to various reasons.
Example of musical class
With instruments, where you had to play rhythm on a song, where other sounds popped up. They had to react to the sounds with the instruments. This was for groups 4 to 6. They started with letting you hear the song, and they joined in quickly. After they discussed what the difficult part was, doing this exercise. After that energizers.
This structure occurred frequently. The teacher was often talking, then in groups the music classes were touched. (about 4 students) this had to be teached based on a theory. The actual giving of the classes did not occur frequently. She thinks this needs to be added. About 26-27 people were in the classes. The classes were big because they are given in the first and second year.
What skills do you use most primarily when giving music classes? (Musical skills, teaching skills)
Organizing, at the end of the day, with young children does not work. It is often seen as funny, so you need to see when the children are productive. Besides that you need to do something that grabs the

children. You need to engage them and inspire them. You need to be musically gifted, children will notice really quickly when you are playing out of rhythm. Children will notice real quick when you are not confident and this ruins a lot of the classes.

Do you use any method for the music classes?

No, a lot of schools use “Moet je doen”, she has a music book with cd’s and songs, it’s called “eigenwijs” she often uses it for her musical classes, to look for songs. A lot of people use youtube but she doesn’t because the book provides her with extra information like difficulty. It also includes the games and activities which she mentioned earlier. She is confident that 9 out of 10 schools will know the book “Eigenwijs”.

Did you have any homework for the music classes at the Pabo?

Yes, we had homework. It was mostly coupling the practical exercises with the theoretical literature. The literature that we got was minor, so in the first instance it could be useful, but after a while it got repetitive because one knew the literature already.

Appendix C - Interview with music educator who is involved in this project

1. What does a typical music class for you look like?
It depends what kind of class it is. When the class is ment to teach the students how to teach a class (didactic), then the focus of the class is “How do I teach primary school pupils general musical skills which connect to the learning goals of the children and the required competences.” This is also known in Dutch as Kunstzinnige Orientatie.

Theoretical classes are usually teached in groups. These groups consist of ±30 students in the first year, and 20 to 25 students in the second year on the Pabo. At the conservatory the groups are smaller, ranging from 5 to 20 students.
Theoretical classes are usually given to the entire class with a powerpoint in a traditional class setting. It is also possible that the students work out something in small groups or in pairs. An example of a class is that the “klank vorm betekenis” model is explained and that the students discover how they can use this model. This can also be done with other models like the model creatief proces from Stichting Leerplan Ontwikkeling (SLO). Students learn to set a learning goal and how to get through the steps in the creative process of reaching this goal.

For practical classes at the Pabo, they have to learn for instance how to work with boomwhackers. This can be done in a setting where a musical play is written on the whiteboard, and the educator (or a student) takes on the role of conductor. A question that one might ask when teaching a class is “Which steps did I take to teach my students this, and how can I teach this to children?”.

Other forms of teaching are also possible. An example of this is a circuit type setting. In this setting, multiple assignments are spread over the class. The students do these assignments for a certain amount of time, and then go to the next one. An example of these assignments can be to order musical instruments on characteristics (eg. short notes or long notes, dull, not dull).

Another form can be something that is called “Binnenkring buitenkring” in Dutch. It translates to inner circle outer circle, and it entails that there are two circles of students. Both circles are made up of the same number of students, and one of the circles stands inside of the other circle. This means that every student stands in front of another student. These two students get a question about the class. One of the students explains it to the other one. The other student gives additions to this answer. When this is done, one of the circles rotate, creating new pairs of students.

Activating working methods are important in musical education. An example of this is that each table in the class has a group. They can then do for example a memory game, where they get a set of cards and they have to match the cards together. One card can then for example be the name of a concept, and another card can be the explanation of this concept. This is good for students at the Pabo, since they enjoy it, and it can inspire them on ways to teach primary school children.

It is important to give a lot of examples of how to do something, so that the students can do it after you.A problem which frequently occurs is that during the internships there is not a lot of room for music in general.

2. What stimulates active participation of students in your class?
Examples of this are:
Asking questions.
Limit the time that the educator is working, in order to create time for the students to work actively. This can be difficult when explaining theoretical concepts.
A lot of variety in classes

There are different learning goals in a class. These goals are leading the direction of the class and dictate what the educator does. Let's say that you are the educator in a class, and the learning goal is that the students know the concept of high and low pitches, then you try to create different working methods of how to learn this singular concept. This can be done with visual examples, but also with small games, or embodying the pitch with the class.

The goal of a class is to make as many neurological connections as possible, in order to create a cognitive representation of a concept. Repeating is important in doing this.

It is important for the students to think for themselves, and participate actively. An important step in achieving this is to make the new knowledge gathered from the class session connect to the previous knowledge that they have learned before. This can be done by starting a class session with an activity that repeats what they've learned in the previous class. After this activity, similar activities can be done with additional steps which include new knowledge. This is called in Dutch "Aansluiten bij de zone van actuele ontwikkeling" and is a theory of Vygotsky. This applies for all forms of education. "Sociaal constructivisme" is the way Dutch education is teached.

3. Can you think of a case in which a peer feedback system can be a helpful addition?
(if no, go to question 3.3)
It is all about the question "are there moments where you can give peer feedback?". This already happens. This usually happens during practical activities, and is given verbally in pairs. He also uses IRISConnect, which is an application in which students can record themselves doing an activity. Other students can then give feedback to these videos. Often used when the educator can not be present during an internship class for example.

It is important that students stay active, when for example someone stands in front of a group, the other students participate actively as well, because they are making music too. It however is important that these students also think about the didactic implications of the class. In this case, a feedback system might be really interesting in this perspective.

An example of how to use a digital system in theoretical music education is that the educator explains something, and asks a question about this newly explained material. You let the students summarize this answer in 4 to 5 sentences. This can be sent to another person in the class, who checks if the 4 to 5 sentences are correct, and gives feedback on it. The sentences and the feedback can all be sent to the educator for analysis. This can be used to check and repair misconceptions, and you let the students think and work actively.

The moment that students start working, they are constantly receiving feedback from the educator. This happens mostly verbally in class assignments, and writing for delivered materials. In general it is not wanted that a class is stopped for giving feedback. If it is possible to give it without interruption it

is ideal.

3.1 When do the feedback moments occur in this class setting?
Typically this happens after an activity. An activity usually takes a couple of minutes. An example is to learn how to teach a class with a play-along video. The student who is in front of the class must give instructions, hand out instruments, etc. This can take 5 to 10 minutes, after which a tips and tops moment comes. This usually takes 2 to 3 minutes.

Classes are a variety of theoretical and practical appliances. This usually alternates during the class. A class session usually takes an hour and 15 minutes, or an hour and a half. 10% or 20% of this class is theoretical, and the rest is spent on practical practices.

3.2. How much time do the students have to give feedback in your class?
This question was already answered in the previous questions so it was not asked.

3.3. What criteria would you want the students to give peer feedback on?
- Aspects of didactic
- Did I differentiate enough (Was the class accessible for all students' skill levels?)
- Did I get the attention of the students?
- Do the pupils tidy up the instruments after the class
- Do the pupils use their instruments correctly
- Own musical skills
  - Can I start or stop the group?
  - Do I know the difference between high and low pitch?

Information like this can also be gathered from educational books, like "Nieuw geluid", or "Muziekmeester"

3.4. What would be a good way to provide this feedback? (eg. open text, Likert scale, yes/no questions, etc.)
As many different things as possible to facilitate variety. A variety of means also allows you to use different types of feedback for different purposes.

3.5. When do you think the feedback should be presented to the student?
At the moment something happens, that someone can have a comment about. So at the moment that a learning moment occurs, or when a student forgets a step. This means that the feedback should be delivered as soon as possible. An exception of this is when it is about the total class session. Then the feedback should be delivered after the class.

3.6. Do you think that the feedback that has been given should be discussed in the class?
This can be helpful to catch misconceptions, or to confirm that a student did well. It is important for students to know when they did well and receive compliments. This is important for students because they can have doubts about themselves. They are also required to work more on their own, in this case it is important that you know that you are doing it well because other people can not check your work. A discussion can also help to learn from each other's mistakes which are discussed. This however can have a negative impact on the class, since one can get confronted if they are doing something wrong. This can be avoided by picking examples from other classes. Then the students will keep it in mind

without being confronted themselves.

4. Do you have a feeling that currently something is missing in your music classes? (eg. lack of instruments, lack of time for personal guidance, etc.)
It is not always clear if the students are working or learning, so insights into the implications of actions in the learning process of a student can be really helpful. This however should not be done via a test, but it should be a measure. Tests already occur too often in the educational system, this is why a measure is preferred. I'm doing something, what do I learn from this? This can also be done to identify the different levels of the students.

A way for students to decide what they can learn can also be a helpful addition. Every student has different competences, and some learning goals might be too challenging, or not challenging enough for them. By letting students pick their own learning goals, you can let them pick a level that they want to work on.When something is too challenging for a student, they might quit, whilst if something is too challenging, they might get bored or distracted. This is why he once did a working method where everyone sat in a circle. In this circle they sang a song and clapped. This was easy and everyone was doing well. After a while, they were required to clap synchronously in each other's hand. More difficult challenges were added over time. This became extremely challenging, which led to students quitting.

It is also important to keep in mind that students can have different conditions like ADHD or Autism. This leads to students requiring different types of attention. It might be interesting to look into supporting different desires from different students into the online system.After a class session the system can ask the students what they find of the different working methods, so that they can reflect on the class itself. It might be interesting to let the students select the way that they want to provide feedback.

Appendix D - Interview with music educator

1. Which classes do you teach?
Methodiek didactiek VO for second and 3rd year students. Klassikaal onderzoeksvaardigheden, graduation supervision for smaller groups, specialization is mainly about examining, how do you examine reports, also tests for musical presentations and creation of musical instruction videos of different instruments and arrangements for different target audiences. He also does internship supervision, and musical history.

2. What does a typical music class for you look like?
He has a chaotical way of working. Not a class is the same.
He does literature presentations, where the literature of the class is split up and divided among students. These students have to research this literature and present it in the class. After the presentation a feedback moment occurs. This feedback is delivered on paper. Dylan Willian has a book called “Cijfers geven werkt niet” which might help for this study. The classroom experiment is a small film on youtube which might also be helpful for this study.

It is important to have as much interactive feedback as possible. This is also done to let the students know at what quality their work is. The dutch word “Kwaliteitsbesef” is used to describe this. He develops rubrics to give feedback/grade. He does this together with students, but in an ideal scenario other educators are also involved in this process. The co-creation of rubrics with students increases ownership.

Practical music classes, with instruments or singing are often taught through simulation. This means that one student is in front of the class, and teaches the other students. The time that such a session takes varies, but is hardly longer than 30 minutes. The first 5 minutes of this class setting are spent on preparations of the class, then 10 minutes is spent on performing the class. Interruptions in this class setting are rare, mostly feedback is provided after the session, which is what the rest of the time is spent on. After this a moment where students can give feedback on the teaching student occurs. This usually happens with the tables of the class in an u-shape, because this increases the interaction.

The role of the educator for such a session is to give instructions to the teaching student, and to check their class preparation and deliver feedback on it. During the class session the educator does not have an active role, but sometimes he partakes in the music class as a student.

Some students can collapse under the pressure of immediate feedback during a class session. This might be caused by a cognitive load, a lack of skill. This is why he thinks that it is better to deliver the feedback later. He also mentions that students might recognize their own mistakes and correct them, which would not happen when they receive feedback before they can do so. It might also be smart to let the student pick if they want to receive feedback during the class, or after because this gives them a choice. Some students can handle it and some don’t, he thinks that the students can bear the responsibility to decide this for themselves. It might be interesting to look into.

For internships intervisions are used. In these situations a student starts with a dilemma, which is discussed. In the next phase of the class, tips are given in these intervision groups. Fast thinkers are dominant in these situations because they can generate answers faster, whilst slower thinkers might

come up with their best answers the moment the class ends.

He also mentions that there is a phenomenon when discussing that some people do not want to participate in the discussion. They are relieved when someone else gets the turn so that they do not have to partake.

3. What stimulates active participation of students in your class?
He tries to make his students aware that they own their personal development. This has to do with asking questions, and the educator wants to do as little as possible during a class session. This creates a situation where the students can do more. This is a process, he is constantly learning which tasks which he is currently doing can be outsourced to students. An example of this is the creation of summaries of working methods. He used to create these themselves but now he let students create them for the working methods that are assigned to them.

It is important to continuously stimulate the students. Ask them what they want to do with something, and then you can connect it to their professional practice. They should be stimulated to work towards this.

He makes use of motivation theories. One of them is autonomy, competence, and relation. Autonomy means ownership, competence means that they believe they can do it, and relation is the connection between a student and their instrument for instance. He really tries to lay ownership upon the students, instead of steering towards a guided learning process.

The expectancy value theory means that a student values an expected end result. It is important for the educator to guide them in this process and make them aware of what is required to reach this end result.

4. Do you implement (peer) feedback in your music classes?
Yes, synchronously, and asynchronously. This means inside of the classroom, and outside of the classroom. They also have to create music instruction videos, where other students can give peer feedback on. The giving of feedback is continuously in the classroom.

5. Can you think of a case in which a peer feedback system can be a helpful addition? (if no, go to question 5.3)
All moments where feedback is being given. The saving of feedback that a digital system can do is an upside of an online system, because the majority of feedback is currently being forgotten by the students. It is however expected that students need to be actively stimulated to go back to their previously gotten feedback. Possible ways to do this is to let students create a summarization of feedback for an assignment.

“Formatief handelen” is an exaggeration of peer feedback, it is not the message anymore, but also the dialog. David Boud wrote a book about this which might be helpful for this study.

5.1 When do the feedback moments occur in this class setting?
Mostly answered in previous questions.

He also mentions that it might be interesting to look into dividing the class, where one student is

teaching the class, something like 3 students are dedicated to giving feedback, and the rest of the students actively participates in the class session which is being teached.

5.2. How much time do the students have to give feedback in your class?
Classes which he teaches take from 50 minutes to two and a half hours depending on the type of class. In this class different things happen which are segmented in different parts, like theory and practice. The amount of time spent on feedback ranges from 5% to 50%. Class time is however the most expensive time. You need to have 20 people in the same place. This is why you need to be careful with what you want to do during this time, and activities which can be done from home should be done from home.

5.3. What criteria would you want the students to give peer feedback on?
This is very dependent on the class setting. What makes a class good?
He sent a rubric for the assessment of an internship for a music teacher at a secondary school. Which will be added under this interview. The rubrics are filled in by the mentor of the student at the secondary school and the internship supervisor based on a class session that they visited. It might be a bit much to let a student fill in all this during a class session, which is why he proposes that a student can pick themselves what they fill out from these rubrics.

5.4. What would be a good way to provide this feedback? (eg. open text, Likert scale, yes/no questions, etc.)
Open text fields are best for nuance, but they cost a lot of time. It might also be difficult to fill in, especially for new students. It can also be done via a rubric. These are easier to fill in. It is possible to create one singular rubric which can be used for an entire course or even education. This allows the students to learn the rubric, since research has shown that rubrics can be a very time effective solution when one fills in a lot of the same assessments. It might be possible to use a singular rubric for the teaching of singing.

Something called a rubric of one is also a clearer way of providing feedback. This is a rubric with a yes/no statement, where the student only has to select one of two. Then they can be presented with a text field where they can elaborate on their decision.

It is also possible to divide the different elements that have to be given feedback on over different students so that they can better focus on a specific task.

5.5. When do you think the feedback should be presented to the student?
Discussed during previous questions.
5.6. Do you think that the feedback that has been given should be discussed in the class?
This can be done in the class. The values created are optimal when this happens with the entire class. Feedback given to someone can also have an effect on other students.

6. Do you have a feeling that currently something is missing in your music classes? (eg. lack of instruments, lack of time for personal guidance, etc.)
He feels like he can use a bit more time, the curriculum is too full and things need to be cut. He does not know what is missing.

Notes from the demo

- It would be nice to be able to select multiple students for receiving feedback
- Maybe a feedback release button, where the educator can select when the feedback is presented to the presenting students.
- Students can find each other's feedback valuable.

EVALUATIE STAGELES

☑ Student moet nog **'extra'** aandacht schenken aan: Lesnummer: Datum:

☐ Voorbereiding ☐ Formuleren doelstelling en beginsituatie ☐ Logische volgorde van activiteiten ☐ Didactische werkvormen ☐ Tijd	Opbouw en organisatie van de les: (Toelichting:)
☐ Gebruik van eigen instrument ☐ Schoolinstrumentarium ☐ Werkbladen ☐ Musiceermateriaal ☐ Bordgebruik ☐ Audiovisuele middelen ☐ Luistervoorbeelden	Gebruik van leer- en hulpmiddelen:
☐ Gericht op de doelgroep ☐ Verstaanbaarheid ☐ Expressie ☐ Aandacht verdelen ☐ Contact maken met leerlingen ☐ Overwicht, leiderschap ☐ Sfeer	Taalgebruik en omgang groep:
☐ Toon aangeven ☐ Zuiverheid ☐ Instrumentaal begeleiden ☐ Gebaren leiden musiceeractiviteiten	Muzikaal-technische vaardigheden:
Algemene indruk van de les: Adviezen/aandachtspunten:	
Eindbeoordeling: Alg./pedagogisch handelen ☐ onv. ☐ vold. ☐ r.vold. ☐ goed Muzikaal/didactisch handelen ☐ onv. ☐ vold. ☐ r.vold. ☐ goed	Naam mentor/begeleider: [redacted] Paraaf:
In te vullen door student Evaluatie op eigen handelen: Aandachtspunten voor volgende les(sen): Eventueel achterzijde van dit papier gebruiken	

Appendix E - Interview with music educator

1. Which classes do you teach?
I'm a musical educator at the NHL Stenden. Every student here is being educated to teach. I also teach in Meppel, but this is an international institution. This changes the way music is being teached, because songs are not in Dutch, and other educational methods are used. The curricula are also different. Sometimes he translates Dutch methods in order to use them in an international context.

2. What does a typical music class for you look like?
It does not matter how experienced the students are, the most important principle is always the musical experience. After this comes the explanation. This means that he finds the practical implications of music has priority over the theoretical implications in his classes. College is always an active procedure. The students are active with things that they can apply in a primary school context. After this comes the theoretical things. There hardly are colleges where they have to be silent behind their laptops.

3. What stimulates active participation of students in your class?
It is important for the students to be physically present in the class. A lot of students often do not attend classes which is a problem at his school. Sometimes it is excusable, when a student has a good reason but they also often are not present in the class without a proper reason.

He expects students to be present and demands active participation. He does this by creating an open setting, but letting the students sit in a circle for example. If he sees that a student has a wait and see attitude, he opens what he calls his "Truckendoos" which translates to his box of tricks. This consists of humor, an adaptation to the correct working level of the corresponding student.

He believes that the skills level of students is low when they start their education. He also thinks that the musical skill level of new students has declined in the past years. He says that a legal requirement of teaching music would be a step in the right direction for solving this. At primary schools musical classes are often skipped or overruled because a teacher has to catch up on a math class for example.

4. Do you implement (peer) feedback in your music classes?
During practical classes, in a simulation setting feedback often occurs. There is also intervision about their internships. This is also why he likes this research. He is really happy with a procedure for a minor. There is a minor called "Muziek Primair Onderwijs", students who have this have an online intervision with ArtEZ students in Zwolle.

"Do students from all musical skill levels pick this minor, or is it only picked by students who have a proper background in music?"
He says immediately to students when they arrive at the education, that all students from all skill levels are welcome in order to invite them in. The minor emphasizes that they are open to students from all skill levels. The first 3 years of the education does not include enough musical classes to get to a desired musical level, and the minor is also meant to fix this. At the same time, the students for whom music is really important also need to be challenged. There is not a real noticeable correlation between skill level of the people picking this minor programme. Students also can have very variable skills in music, where one may not be able to sing properly but can dance really well.

Feedback is usually given in the simulation settings in a verbal discussion after a simulation. This happens in the class or in smaller groups. There can also be variants of this where they have to write tips and tops on themselves and you discuss them after. He likes during a discussion that all the students get to hear about the feedback. An example of the exercises to give feedback on is done on two things, one can be a singing class (Can be simple or complex, depending on the skill level of the student), and the other thing is during a musical activity which takes less than 10 minutes. For students who lack confidence, they can do this exercise in small groups of 2 or 3 students. They should however show that they are participating actively.

During the minor, students can record themselves. They are then uploaded on a platform where other students can see it, and they can give feedback on each other. They use “Presentations2Go” for this.

When a student has done a simulation, the same day they need to send a mail to the educator stating which feedback they have received and how they understand it, what do they do with it? Do they agree with it or is it more nuanced?

5. Can you think of a case in which a peer feedback system can be a helpful addition? (if no, go to question 5.3)
On a Pabo it is always a problem that there is a lack of time for classes. This is why you need to be very careful with what you do during the classes. It is very valuable to have these practical moments during the classes, also to keep the students enthusiastic. The feedback which they give to each other is also really valuable. It would be really nice to be able to give feedback after the colleges so that it saves time during the class, or that it can be read afterwards.

5.1 When do the feedback moments occur in this class setting?
Has been answered in previous questions

5.2. How much time do the students have to give feedback in your class?
It is difficult to say this, because not every class has a practical element. During one of these particle sessions, a max of 5 minutes of discussion is handled for a 10 minute session. Every student takes on the teacher role once. Sometimes when there are big classes, they are split up into smaller groups. However it is ideal to do it with a full class. Every student gets the same task, but the way how they approach this task can differ greatly. This often also depends on the skill level of the students. You can be a really good musician, but that does not make you are great musical teacher.

5.3. What criteria would you want the students to give peer feedback on?
- Is the activity/song chosen correctly, does it fit the target audience?
- Are musical didactic principles used?
- It has to be prepared properly.
- Everyone needs to be able to follow it.
- It needs to fit in the allocated time.
- The balance between talking and playing. They don’t need to just talk.

The criteria mostly grade how the student is teaching, and not how they are playing. When there are musical errors, the educator might even interrupt the class because he does not want the student to learn a song in a wrong way.

The target audience for a simulation is the children in the class of a primary school.

5.4. What would be a good way to provide this feedback? (eg. open text, Likert scale, yes/no questions, etc.)
There is a wide range of different types of feedback which can be given. Like how you do on the internet with a rating with a star system, thumbs up or thumbs down. He thinks that it would be really nice to be able to vary with different ways of giving feedback.

This usually happens verbally. In small groups of 4 students for example.
“If you’d replace this verbal giving of feedback with a digital system, would that be better, or less ideal?”
The better part is that everyone is triggered to give feedback actively. What is more difficult is that they can be given incorrect feedback. How do you filter this then?

An example can be that there are tips on the left, and tops on the right in a livestream. Reacting to these tips and tops live would be nice to spark a discussion.

5.5. When do you think the feedback should be presented to the student?
It has to be as soon as possible to have the optimal learning effect. Time is however really valuable for these class settings. This is why he uses the mail system, so that the discussion can be brieve, but that the recipients of the feedback are required to think about it after the session.
“Does this mean that you’d also be able to present the feedback after the session entirely, so that you save time in the class?”
He tries to avoid having the mail turn into a mailing conversation, because the information for this is also really valuable for the other class members. So he thinks that the discussion sparked by feedback is really important, as long as it’s to the point. It shouldn’t cost more time than required, but if it is required it can also take longer than planned which is okay.

5.6. Do you think that the feedback that has been given should be discussed in the class?
Has been answered in the previous questions

6. Do you have a feeling that currently something is missing in your music classes? (eg. lack of instruments, lack of time for personal guidance, etc.)
There is always room for improvement. He always reflects on his classes, by asking himself the question what would I do differently next time. He has some classes of which he knows that they work, and he has been doing these for the past years. What he really thinks is lacking is the position of music in the curriculum. He says that the lack of time is a real problem in musical education. He thinks that there is a maximum that can be reached in a certain amount of time, and focussing on how to do it even more efficiently is not the solution.

Appendix F - Interview with music educator

1. Which classes do you teach?
I teach methodology didactics classes mostly to students in the second years, also on primary education.

2. What does a typical music class for you look like?
It can take on different forms. A part consists of internships. They do this in groups in primary education. They have intervision sessions with this, where they reflect on their internships. The class that is currently having this session has 9 students in it, which is already a good size for an intervision group. Another part of the class session consists of talking about the literature, practicing working methods, which is very practical. They get teached what they can do for a class session during their internships. They work in the different domains of music here. The students also get work assignments which is also where they are assessed on. These assignments are made individually, they currently write their own song, and they have to create a checklist for the Pabo teachers and students. These checklists consist of different factors which they have to make up themselves to make it simpler for the educators in the primary education to identify which songs fit a certain class. It's a helping method which I let them develop here. It can consist, for example, of which tonal ranges suit a certain class. For students it is really nice to create these criteria because when they start working in primary education, they have to work together with other teachers. This helps them to coordinate with them to get criteria for understandable basic knowledge in their teaching.

So the teaching consists of multiple things, they are theoretical, but also practical where the students have to do things on their own, but also personal assignments where feedback is often given.

Before writing this song for a personal assignment they read a book about how you write a song for specific target audiences. In the class sessions there is time for feedback in these sessions and halfway through november they have to hand it in. The biggest part of the creation of a song is done from home, and they go over it in the class after which there is a feedback moment in the classroom. From after the christmas break the class sessions will consist of presentation moments where students have to perform their created songs. With these song performances they also need to prepare a class session. They need to act out like this class is a real class (as in a simulation setting) and then they teach the class with their own created song. The other students in this class then give peer feedback to each other via a peer feedback form. I want to have 2 students giving this feedback, whilst the other class acts out the class session. This is because the class session is too active to give feedback at the same time. The students who have to give feedback can zoom out this way and see what happens because it is different to look from the outside than when you are inside of the class session.

In total the lesson takes 100 minutes. The class session that the students teach takes 20 minutes. Of these sessions about 5 minutes is spent on feedback. The other 15 minutes is spent on teaching, and setting and cleaning up the class. It is really a lesson component.

3. What stimulates active participation of students in your class?
LessonUp really helps her with this. Because of this everyone participates in the class session. After the class it is possible to see from every student what answers they have provided. This is helpful

because this helps identify if the targets for the class are too high or low, so that they can be adjusted accordingly.

During the practical exercises everyone is working anyway. Tasks are provided to students, for example one student can get the task to prepare an energizer. The entire class then participates in this energizer. The educator also participates in this.

4. Do you implement (peer) feedback in your music classes?
Yes, especially during the final assessment of a task. This is the only place where it currently happens.

It is also interesting however to implement this with internships. Currently every student is going to do their own internship, a visit by the educator occurs once, and then the internship is already over, but there is not a lot of material to discuss, which can be really valuable. This is also because of AVG, which can be especially difficult with primary school children, but it can be a bit easier because it is for educational purposes. Other teachers use IRIS Connect for this, but this interviewee has not used it yet. Currently the assessment is disconnected from the actual internship. They use role play which is really different from when you really see something in the class on which you can respond.

Summarised: Peer feedback is only used on one specific task, but a wider implementation of this would be nice.

5. Can you think of a case in which a peer feedback system can be a helpful addition? (if no, go to question 5.3)
I think for multiple moments, now the feedback occurs at the end, whilst it would be nice to have it at multiple moments in the class. So to have a feedback moment every couple of weeks. Because there is always something to reflect on. They are always working on certain tasks which are only being tested at the beginning and the end, but it can also be really valuable to test this in between sessions. Especially for this education. So not only feedback at the last moment because peer feedback is really important to have in an early phase so that students can continue on this.

A couple of the learning goals are dedicated to the interviewee, which have to be reached at the end of the semester. During their internship the students do reflect on themselves but not on eachother which is a loss. So it can be integrated in the internship.

5.1 When do the feedback moments occur in this class setting?
In the context of writing their own songs, this would happen in week 2, this course has 15 weeks, so in week 2, then a couple of weeks no feedback sessions, and week 6 again, then is spring break, then somewhere between that, and then at the end again. It does not matter when this moment is given in the class. The feedback moments can take about 15 minutes. This includes the reading of the work and interpretation of the work of students. This might be more difficult for newly starting students. For these students it might take a bit longer. Also because you are assessing your classmates.

5.2. How much time do the students have to give feedback in your class?
Was already answered in previous questions.

5.3. What criteria would you want the students to give peer feedback on?
That is dependent on the assignment. For the create a song task the following tasks are important

- That it fits in the vocal range of the children
- That it connects to the target audience (They have had theoretical knowledge about this)
- Not how it is performed because it is more about the song itself
- It is important that the class preparation connects to the song. You write a children's song so that you can use it for your musical goals, so the students need to be able to use this properly in a class session.

Mostly the content of music is what is important towards the target audience of children. This does not mean that the song can not be complex musically, but it is important that it is for the children, it should not be the newest hit for everyone.

5.4. What would be a good way to provide this feedback? (eg. open text, Likert scale, yes/no questions, etc.)
A likert scale would be the most efficient. Open answers would be really valuable as well, but they might take a bit longer. So depending on the time available. They are both possible, but the likert scale would be faster.

A rubric is really nice, a single rubric where you have criteria in the middle with two segments "What can be done better" and "What is good about this". Rubrics seem like the most fair way of assessment. A lot of forms exist for the educators to assess students where they can select "insufficient, sufficient, more than sufficient, good". This does not say a lot. For example after a visit at an internship it does not say a lot. The criteria which are looked at are really good though.

After an internship a broad discussion occurs where a lot of feedback is given to the students. When this session is done, they get a grade, for example "more than sufficient". The students often only look at this grade, because that says that they passed the internship without caring too much about the feedback provided to them during the discussion. Students think a lot in grades, which the educational programme wants to lose. They want to create insights in the learning, but currently it is really connected to a pass, instead of development.

If you look at this way of thinking, open answers might be better than likert scales because it says more. A combination of both might be best. You can not avoid the tool being efficient because of the limited time that is available in class sessions. Often feedback is an extra, for which the educators can not spend a lot of time.

When students get a feedback moment during their class, it might be required that students also can show that they have improved in the class sessions, to show that they can do something with it. When they receive feedback, they can continue with the assignment but they also need to get the space to show that they can do something with it. This is important to show the students that they progress, but also that they can continue with their work. Often they develop in a short period of time, the educator can tell this to them, but they also need to see this for themselves. That is also part of the learning process, but tools can really help with this, creating insights in the progression that students make would be really nice. Rewards can be a valuable asset for this. To gamify it a bit. This is also a part of lessonUp. For example a ranking of a question which I think helps to stimulate.

5.5. When do you think the feedback should be presented to the student?
Question was answered in previous answers

5.6. Do you think that the feedback that has been given should be discussed in the class?
Yes, during a moment in the class. Everyone gives verbal feedback in the class, or via lessonUp. The discussion here is based on a case, after this case there is a moment of feedback. The student who is receiving feedback can formulate a question like “How can I improve this”. Everyone is really involved in this. Everyone provides answers. That is the only way that is currently being discussed. It can also depend on the class. The feedback is always written down so that they can process it.

6. Do you have a feeling that currently something is missing in your music classes? (eg. lack of instruments, lack of time for personal guidance, etc.)
A clear structure in assessment because a lot of varieties are possible. Also more insights for the students in this so that they know what to expect. This interviewee hands out the assignment forms, so that the students know what they work towards. It is often very different how the assessment is done. A more broad instrument for assessing students would be a great addition which can be used in different forms so that it fits different class sessions. Peer feedback can be a solid part of this.

Students currently grade each other and this also counts towards their final grade.

There is a difference between students, in that some students are really good at asking questions for their feedback, whilst other students immediately jump into the assessment. I don’t know if this is something that you can overcome with some sort of model, but feedback is meant to help each other further, which is really subjective. These feedback questions are often used in the intervision groups. One student has a case and a problem that comes along with this case. After they present this case, the other students in the intervision group can ask some questions to clear up the case after which they can give tips to the student. Often the question round is skipped. They assess the situation instead of giving constructive feedback to each other. Some students are not good at giving constructive feedback. They also assess the situation instead of looking at the performed case. The educator sometimes stops them when this happens because it turns more into moaning instead of a helpful discussion. It is important how you put the students to think to see which answers come. This is important for a peer feedback tool that there is scaffolding in place to ensure that proper feedback is given instead of judgements.

The educational institution works with a system where they can follow students, called “Leer podium”, it would be nice to have a feedback system integrated in this system. This is the place where all the lessons, student tasks, for example for assignment deadlines.

Appendix G - Interview with music educator

1. Which classes do you teach?
I teach 3 classes here, one is the guidance of the yearly music production, this is especially the business side. The other is the organization of the culture trip. This is how it is organized, not the actual culture trip. It focuses especially on finance, having the right people in the right places, making sure that the transport is properly arranged. So that students can learn to work on projects. The final one is that he is the main subject teacher of secondary education, upper secondary education music. Here they get methodology, didactics, literature, intervision and internship intervision in the region.

Until 3 years ago, the interviewee teached a lot more music, but now he is the head of the educational programme so he has only a small portion of his courses available.

For this interview the main focus will be on the music classes that the interviewee takes.

2. What does a typical music class for you look like?
A typical music class is a class which has a clear beginning and end, where students are as active as possible, and an active variety between working methods exists. Clear instructions with a goal is impossible. The goals are always connected to the learning goals of the class. When a student can not tell at the end of the class session what they've learned, teaching is not valuable. Anything can happen during a class session, so a goal might not be reached. This means that during a class session the goals should be adjusted in order to have finished the class session before the bell rings. If this does not happen, the bell rings half way through the learning process of the students, which decrements their learning.

For practical exercises, listening is always the center of attention. Listening is something to increase your knowledge, and train your listening skills. But also during singing, playing, moving, everywhere, listening is the center. You can't do anything in music while listening. You can't test either what a student does and does not know without listening. After this making music is the most important skill, this is done vocally and instrumentally, improvising based on the luggage you have at that moment, seeing the possibilities. Rarely composing music, but often time is lacking to do this. There are a lot of colleagues who only sing with classes or play with classes, but the interviewee finds that a broader palette needs to be offered to the students.

It is difficult to focus on a specific class session for implementing a feedback tool. Somewhere there is an instruction or a start in a lesson where students need to make a decision. It is important for students to be able to make decisions. These decisions can be for example on questions like "What are we going to play?", "What are we going to sing?", "what do we need for this?". This gives the students ownership and direction. Then a transformation process happens, the students have to prepare something together. A teacher can teach, he can coach, he can guide, he can do a lot of things, but at the end the students need to present. This can be done in two ways, they can do this live in the classroom after which you can let students reflect, or they can record it, after which written feedback can be given on this recorded video.

What the interviewee notices is that when peer feedback is implemented, the students need to be given vocabulary. This means that before the project starts, they need to know what the criteria are

and what direction is required. Based on these criteria they need to be forced to say something deeper than “nice”, or “not nice”. This can be done by attaching a vocabulary to this. So when one criteria is that it is really important that the correct pitch is hearable, or that they play the correct notes, then they have to say something about that pitch or the notes instead of nice or not nice. Scaffolding in the shape of thermology is used to direct the students in the correct direction.

3. What stimulates active participation of students in your class?
By not doing too much themselves. The danger lies in that an educator wants to do things too good, which leads them to keep talking, whilst the students want to make music. Students can work perfectly by themselves when a clear task is formulated and the following 4 criteria are met: it is not multi interpretable, every student needs to know what they should do, how much time they have, and what the desired noise level in the class is. These are the criteria for students to work by themselves which work for this interviewee.

To manage time in the class and keep the students engaged, a helpful trick is to underestimate the time. For example, when you think a task takes 30 minutes, you can tell the students that they have 10 minutes to complete the task. When they are not done after 10 minutes, you can give them extra time. This avoids that students do nothing for the first couple of minutes after they get an assignment and it leads them to start working quickly. It keeps the students in an active role. It is also very important for the students to know what they need to have when the exercise ends. This can be done by making the criteria clear to the students. To let them know what their product needs to have in order for it to be sufficient. You need to let them know when the exercise is done, and during this process you can seduce the students to let them do extra work in order to improve their work and make it more attractive in a musical sense. Here you can play with your criteria. You need to state a minimum at the beginning, these need to be measurable musical criteria. This often happens via rubrics.

What he often sees with students is when they formulate goals, that they are often not measurable. So the correct rhythm, correct pitch, singing like noted, the correct pronunciation, correct singing posture, all things are measurable and needs to be focussed on in order to work towards goals and know when you’ve accomplished them. This is also really important for peer feedback. When measurable criteria are given to the people who give feedback.

4. Do you implement (peer) feedback in your music classes?
Not during the process, which he wants to do more because he thinks feedback steered learning should be implemented more. During the lessons they need to see what can be done differently or better, and ask that with targeted questions. What he implements more is an evaluation at the end, but this is mostly a product evaluation.

The key to development is evaluation moments at the end of a class session. You can learn most from yourself, not from your internship teacher. The teacher gives you something back, in the form of tips and tops. The teacher says what he or she thinks of what the student does. This does not directly improve the student because the student needs to be seduced and challenged to think about how the lesson worked, what went well, what could’ve been done differently, was the task completed, was it challenging enough, was it too fast, was it too slow. There are a lot of things to let the student think, and make him responsible for the succession of the lesson. The interviewee currently does this a lot at the end of the session, but he thinks that it could also be done during the class session itself.

What often occurs is that students do not get a chance to do something with the feedback that they've gotten. When they get the results of a test, they get the grade and do nothing else with it. It's a shame.

A cultural shift in education is required, what currently happens is that when students want to help and think about the quality of a lesson, and also give feedback on how the teacher is teaching, these students are often seen as difficult students. Teachers are more experienced than students and often have difficulty accepting feedback from them. When a student says to you that you talk way too much, and that they want to start with the class session, it is a student who helps you improve your class session. It is not asked- feedback which is challenging for a lot of teachers. So for a peer feedback system on teacher level were the students give feedback to the teachers a lot should happen before it can be implemented correctly.

During intervision settings, the simulation class setting often occurs. When a student says that they have difficulties with something, or that something always happens, they can reenact it. After this they give feedback. This is in some form also feedback from students to teachers, because the student who is teaching is in some form a teacher of the group at that moment. It is also difficult for the student who is teaching to receive this feedback.

By giving feedback to the educator during the regular class sessions you can force the students to be engaged constantly, and let them think about the class session. To tell them to pay attention to a set of criteria, not too many criteria because it does not work if students have to pay attention to 10 different points. And there needs to be a verbal agreement between the educator and the students to make sure that they both are behind this way of working. When the interviewee does an internship intervision, he preferably would interrupt the class multiple times to give feedback in order to supply an learnable situation. Some students might say that they do not like this, then he does not do this. When this happens, a student can lose authority in the class, the feeling that they get a chance the try it for themselves is also lost, because they are interrupted before they get a chance to correct themselves. Students sometimes can't handle being interrupted in the class, but they know this for themselves. However when one gets interrupted in the class, they might struggle for 10 minutes correcting a mistake, but this means that they do not have to struggle with the mistake for the other 50 minutes that a class session takes, and they have a successful experience.

5. Can you think of a case in which a peer feedback system can be a helpful addition? (if no, go to question 5.3)
During practical intervision where you rewind internship experiences, or are in the preparation, or during the learning of a play. Everyone does it, show it. Then it is done, and then everyone is done and the person who gave the lesson guides this.

The other moment is when working with IRIS Connect, there they send something to a supervisor, at the end there is a feedback moment.

Especially in the physical classes here, every major course has an internship intervision, or practical intervision where such a system could be really well suited.

5.1 When do the feedback moments occur in this class setting?
At the end it is really valuable so that everyone can say something, and during the class, it is always searching for balance. Do you interrupt the class to give the feedback, or do you wait and give the

student the chance to come up with the solution for themselves. It might be best to do this based on what the student who is teaching wants, they can stop the class session themselves. This can be done for instance when they can't grasp the attention. It is really challenging to let the students interrupt the class for themselves because this gets the tempo out of the lesson.

So the feedback moments might occur when the teaching students want them, and at the end of the session.

5.2. How much time do the students have to give feedback in your class?
That is about time management, and the students can decide this for themselves. They get 25 minutes to teach a class session, hear all the feedback and finish it. He can not say that everyone can give 30 seconds of feedback, because some students have more pointers. When you let time dictate this, some students might leave things out because of time. The teaching student fills in how they want to use this time. It usually consists of 15 minutes of the practical class session, and 10 minutes of feedback. This does not have to be all at the end, but some feedback can also be given during the session if the teaching student wants this.

5.3. What criteria would you want the students to give peer feedback on?
It is really about the way that you make contact, how you talk, the speed, everyone that is non-verbal. What do I radiate, am I open, do I have contact, can I make pace, what is the tone that I'm using to talk. The second one is more content related. Are my instructions clear, do I not talk bull shit when I do not know something? It is often that educators in their head get every step but that students can not follow it. Students are really nice people, when you ask them if they understand it, they will always say they do even though they don't. Control questions to identify if they follow can paint an entirely different picture.

So is it correct content wise, the order, the speed, the instructions, and questions that I ask
And what way do I present myself? If I want to get a group in action and I'm not acting like a nice person, they will not listen to me. These two main criteria are really important.

When we talk about practical intervision, even though it is correct content wise it is about which goals were set in the beginning. For example in the context of a choral piece, multivocal singing with the class. Then you need to know in advance what you want to hear before you are happy with it. So the educator wants to know beforehand what the teaching student wants to achieve. This criteria can be, do they know their own part, is their singing attitude correct, no one is bored and everyone is active, even when they do not have a part to sing. So everyone at all times is in an active role, the tone, rhythm, and pronunciation should be correct. The teaching student also needs to let the other students know when he or she is happy with what they deliver.

Often the teaching student says, I'm happy with this, but no one ever asks why. Those are the measurable musical criteria. That is something you can talk about. Was it clear? Then you are active with your students. It is also about expectations management.

5.4. What would be a good way to provide this feedback? (eg. open text, Likert scale, yes/no questions, etc.)
At the moment you do not want to interrupt, you would want a user friendly rubrics. Often rubrics are seen where the assessing person is writing a lot. It would be really nice to just have a plus or a minus,

what does not cost a lot of time but which really makes clear what can be improved, where is the development, where are the learning opportunities for this student. It should be fast and insightful without having to write too much.

5.5. When do you think the feedback should be presented to the student?
When it is really necessary, he would say that it should happen during the process. at least when the student approves, but definitely at the end of the session. So you can say you get the feedback now, what are gonna talk about, and apply it in the lesson. It should be done when the student still has the possibility to do something with this, otherwise you get the situation again that one gets his or her test back, and that they do not do anything with the mistakes that they've made.

It would be really nice if students can instantly see which feedback is given on their monitor when they are teaching a class so that they can switch directly. He does not think that a student will collapse under the pressure of receiving live feedback in this way, because it is given in private. Not everyone knows that feedback has been given which does not undermine the authority of the teaching student. When one can see the feedback live on their screen, they can know for example, "I'm doing really good, but after the class session I do not reach my goal because I lack speed". If you can see something like this on your screen, then you know what to chance. And the information is only for the teaching student. That would be great.

5.6. Do you think that the feedback that has been given should be discussed in the class?
This is a difficult one. Discussion often feels like an explanation why one did something, or that they come up with excuses why they did something like this. Because of this, the interviewee often says that he does not want a reaction when he provides feedback. This way it can land, and the student can do something with it what they want. Often the asking of a question is way more important than the answer. This sparks students to think. You get the feedback, do something with it. At the moment one gives feedback and another person does not agree it is not a problem. It does not result in negative learning, one finds it important, the other does not. What is the relation between the feedback giver and the receiver is also important. They might not like each other, or really like each other which influences the feedback. This is why some feedback sometimes should not be discussed. If for example three students give the feedback, you can do something with it. If you do not, it is your own process.

He has never seen feedback that was incorrect. Even students who are not comfortable in the class, the moment you have a professional learning setting and there is an educator to manage this process, the approach is always very fair and professional. Lets say incorrect feedback happens, and a discussion forms, he would let it go. In the first instance it should be: give the feedback, and then collect it. Everyone has the goal to become a great teacher. Students have the feeling at the moment that they give feedback they are really serious about this, especially when an authority figure like an educator is present. He would not know how it would go if he was not present. When you work in groups during a workshop for example, it does not matter how old you are, when the leader of the workshop is standing close to your group everyone becomes more serious. People want to let the authority figure know that they are saying good things. That is how it works, so it will probably not be otherwise here.

6. Do you have a feeling that currently something is missing in your music classes? (eg. lack of instruments, lack of time for personal guidance, etc.)

It would be nice to have the students in an even more active role. It is currently 50/50 but he wants to capitalize more on the knowledge of the students. The 50/50 ratio is caused because a lot of time is spent on a lot of explanations. A lot of questions are often asked about the classes that the students teach for example during their internships, and how the educator would solve it. What would be best is to say, that is an interesting question, and lay it off to another student to answer it to stimulate learning from each other. There is a class of semi-pros, so you look at education from another way so now they can talk with each other about this. The educator can play an facilitating role in this process when for example a bad suggestion is given, but it is important to give space to the students to talk about their experiences.

Appendix H - Interview with music educator

1. Which classes do you teach?
I teach at a Pabo, I teach music there. I do this for first and second year students with various tasks that they have to do, and internships. I'm also a PPO person aka Tutor where I teach personal development. I also think that feedback is very fitting for the PPO classes.

2. What does a typical music class for you look like?
We have 4 different modules which we offer in the first two years. In the first module beat and rhythm are the focus with musical instruments. An exercise is to teach a primary school class with this. The second half of the year, the second exercise is that they are trying to teach a song to a class. They should know how to guide a song in school. The second years have to pick a musical element that they want to improve themselves. Halfway through this course there is a feedback moment, where they give feedback on a presentation of each other. At the end they also have to end in a presentation. In the last module of the second year they get teached how to teach toddlers.

What does a class look like? That varies a bit. In most classes my colleague [NAME] and I show the right example. So we teach a musical class, like they have to at their own internships. So we do a lot of demonstrations, we practice together in the class. One time a module is more focussed on singing, the other one on moving. In the singing module we also do something with melodic instruments. In the first half of the year they have had the rhythmic instruments. So a lot of examples, a lot of imitations, a lot of doing together.

My colleague teaches the rhythmic classes. He also uses the simulate setting. Here they do not really give feedback to each other on what happens.

The students have to participate in the class sessions because they have to experience what it is like to use their own voice, or instrument. This allows them to become more skilled. They also get knowledge about the theoretical background this way. And also the didactic skills they learn by themselves in small groups. They get demonstrations of this so that they can use it later on in their own classes.

Leading a song is when a class knows a song, how do you start it, how do you decide the pitch, stuff like that. So it is about singing, the one time you learn the class a song, later on you show them that you can lead them. That you can hold tempo, and stop the song and say something about how it sounded so that it can sound even better the next time.

3. What stimulates active participation of students in your class?
What I just said, they have to participate with everything. I try to talk as less as possible. Do a lot of activities.

4. Do you implement (peer) feedback in your music classes?
A little bit. In the module for the second years where they pick their own procedure, halfway trough the semester there is a class were they give feedback and feed forward so that they can improve based on this in the remainder of their internships. This class session is planned for next week. I have 4 groups of second years. The idea is that we split these classes into small groups who work on the same

theme. For example, I find this organization of musical class difficult, then we put these together and we let them discuss what they have done on their internship because they have already worked on the exercise. I have a paper where they write feedback on. It actually is a talk. At the end there are a couple of points on the paper so that they know at the end what kind of feedback, tips and tops they have received.

It is not about the way that they hold their presentation. It is more a talk where they talk about what they did in their internship, what they did and how it went so that other students can give tips and tops on this so that they can improve each other.

5. Can you think of a case in which a peer feedback system can be a helpful addition? (if no, go to question 5.3)
If you want to check later for the students by themselves so that they become aware of their own actions, it would be really nice for that. Also to expose what can be improved. The involvement of what another person is doing is also good. I do not have the idea that the students, for example when we demonstrate something as teachers, that they are not less involved then, but it might be that when you do another sort of activity it might be beneficial. When I'm a tutor and do the PPO classes, in these classes students have to present sometimes, and there the involvement could be improved so that they all have to say something. Then it could be good to get the students actively involved who are listening. So that they can learn from each other. I think that this can be used for every course on the PABO where groups of students are presenting, maybe that can be improved. I do not know what kind of feedback my colleagues use. I think that sometimes they might use apps or something but… Maybe something else that is digital and not on paper might be nice.

When students are following the class sessions which we demonstrate, they are able to retrieve the information afterwards partially. But they might have to think, what did we do in the class, and then they can grab the powerpoint and see what we did. Then I hope that they unconsciously saved it or something. That.

5.1. How much time do the students have to give feedback in your class?
Not a lot, sometimes at the start of the class we talk about the internships, that is mostly that they tell something about it but not very often feedback is given on this. At the PPO classes, we have working methods where they converse with each other, but this does not occur in every class.

On average, as I have to do it over half a year, that is not a lot of time left. Some classes have nothing at all, some classes have 5 or 10 minutes of feedback. In the musical classes we find it very important that it is mostly doing, and less talk.

In the class session where feedback is given which is next week, I spend most of the class session on feedback. This is about 1 hour of the 1 hour and 15 minutes class session.

5.2. What criteria would you want the students to give peer feedback on?
Tips and tops it is mostly, I think that is now the case. We do not have any criteria for the giving of feedback. In internships we do have a form, when the tutor gives feedback to a student. I try to say that the feedback should have the sandwich technique. That less nice feedback is between nice feedback.

I think that this lack of scaffolding might decrease the quality.

5.3. What would be a good way to provide this feedback? (eg. open text, Likert scale, yes/no questions, etc.)
Preferably personally. Our students become teachers, so a bit of pedagogical interaction with each other is really important. Also because of the digital words that we live in where unasked feedback is provided on everything via the means of social media. I find it always really nice to have people do this face to face.

On the other hand, on paper, or another way how its saved, it is really nice for later to look back at it and get something from it. And also i think that when you have multiple choices or a list, it says less than when you say something and explain in your own language.

A combination would be nice, something you can just tick off. When we talk about leading a song, there is a set of steps which you can say yes or no to. Preferably with a field where you can add some text.

5.4. When do you think the feedback should be presented to the student?
Preferably directly. Then you can use it as a formative action. Students can then change their actions based on the feedback. When you only give summative feedback it is not that worthy. Sometimes I do write something when someone hands something in, but I only hope they will look at it.

By coincidence we are working on changing our curriculum, where we want to implement more formative feedback, instead of summative feedback.

Formative feedback is giving feedback during the process so that the students can adapt based on this. Summative is a feedback moment at the end of the course where you leave a lot of moments were you can ask and help students.

5.5. Do you think that the feedback that has been given should be discussed in the class?
I think that it would be nice to do something like a conversation, so that you can react based on this. Because when you get feedback, you can not check if you interpreted the words correctly, or why did you find this? If you can not ask these questions you still leave something on the table and the effect might be the same as summative feedback.

6. Do you have a feeling that currently something is missing in your music classes? (eg. lack of instruments, lack of time for personal guidance, etc.)
The time is very limited, and there is already a lot in it. But I'm doing the module for the second year there. I would like to be more aware and be able to monitor, during the last class session I told them "during the next lesson you all need to present your piece." and there were a couple of students who said "I still have not started". There I miss that I can stimulate students to do it for themselves. I told them every lesson, guys go do something, did you start already. Apparently some students have not gotten this, without me knowing. In that a bit of becoming aware, what am I doing, am I doing it in the right way is maybe something that I still want to implement or do something with I think.

And in the practical piece. My colleague [NAME] does that with rhythms in front of the class which is really nice. The module that I'm going to teach is about singing, which is always a difficult topic because the voice is a very vulnerable thing. Singing in front of a group is always very thrilling for

them. And for their peers, it is even more difficult than in front of their own class. I would like for them to come over that, maybe even by giving feedback in a specific way where they do not get punished for the quality of their voice, but that you can say, you sang at the right pitch “Check”, you have to have the right composure, “Check”. So that it is not personal about their voice, but that is a difficult thing.

And maybe a bit of safety when you give feedback is something you certainly have to consider. How safe is it to give and receive feedback? If you do it with people from the same age.

“Do you think that the feedback shouldn’t be anonymous, or that they shouldn’t be too harsh on each other and take shots at each other?”

The last thing for sure, and I’m also not for anonymous feedback, because I think that this makes it easier to give too harsh feedback to each other. Look, our students do a pedagogical education, they all are a certain type of people who would not take shots at each other. On the other side they need to learn how to give feedback, and how to receive it, and that it is never meant to damage someone. That does not mean that that is always the way that it is received. It is also dependent on how the student is, and how they are feeling at the moment.

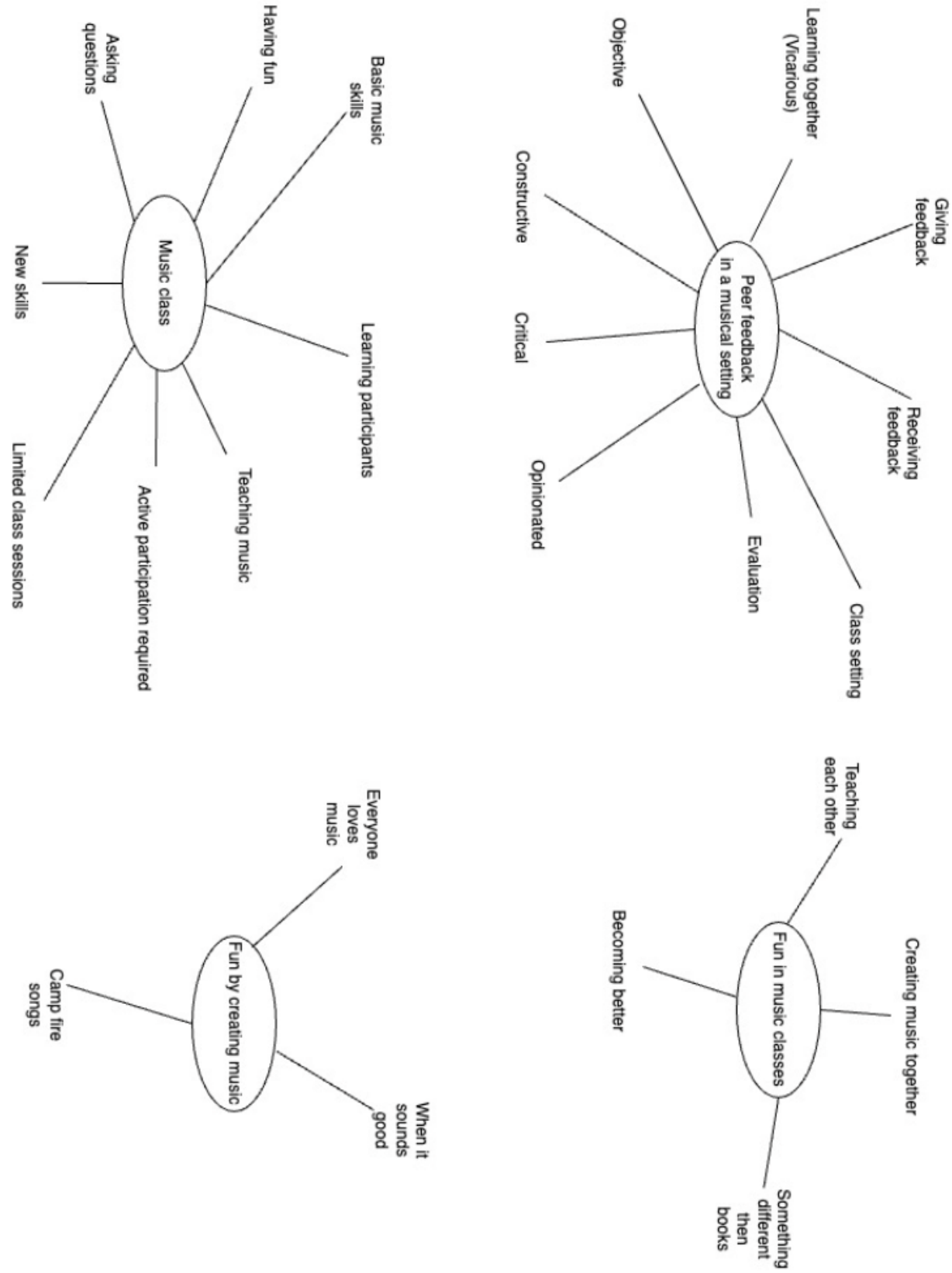
“Previous research has shown that the quality of feedback declines when feedback is not anonymous because students no longer dare to be honest. Is this a worthwhile tradeoff in your opinion?”

Well, the question is, can you solve this in one or another way? I encounter a lot that they are too nice for each other indeed. I’ve had a group of students where one of them did nothing, but they did not say anything about this student in the final report. I would like them to be a bit more straightforward here, but on the other hand, how do you do this, without the sensitivity?

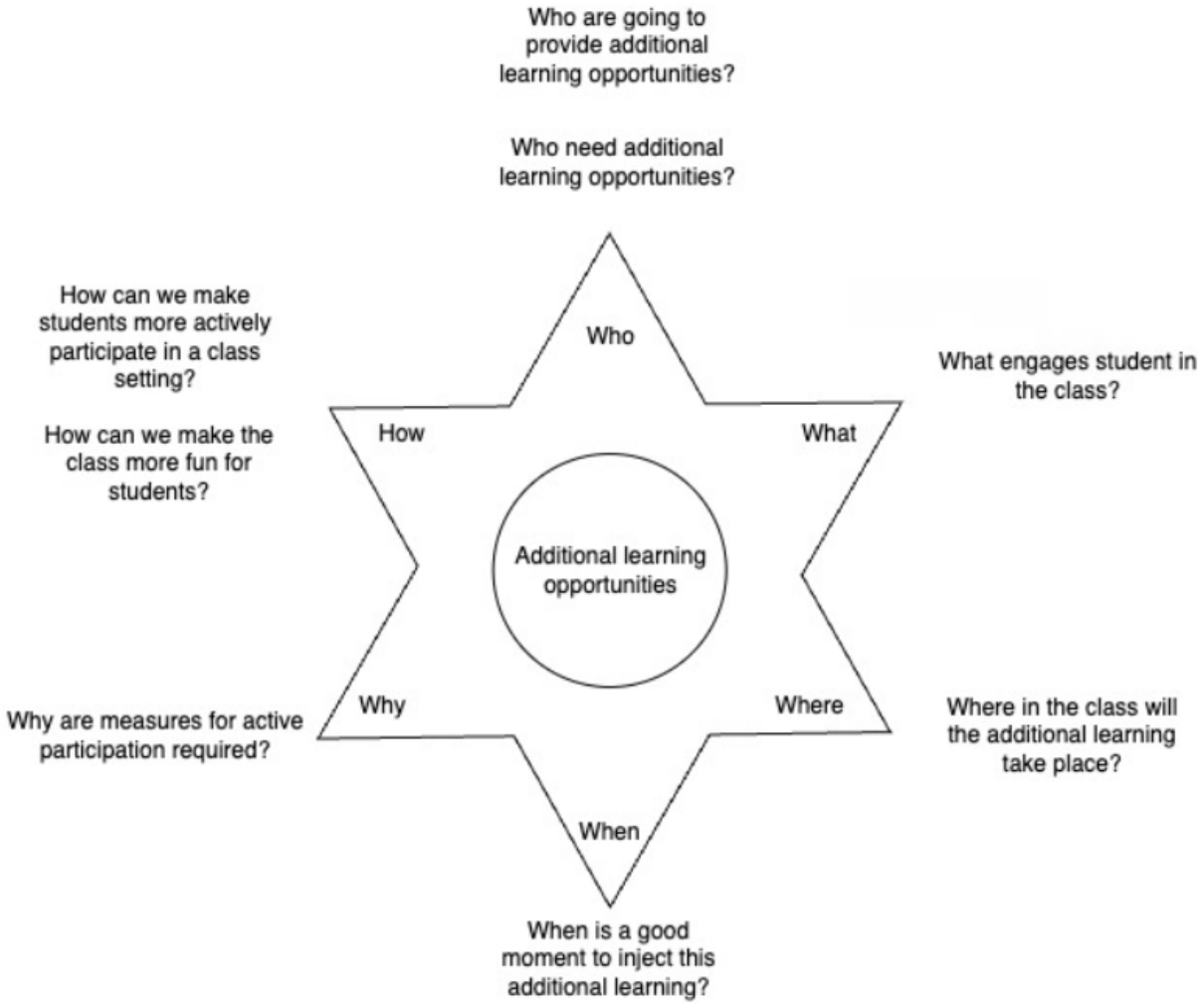
“*Should this be solvable by letting the educator monitor the students, so that the educator can see who said what, so that the students get the feeling of responsibility that they can not just say anything.”*

Yes, that might be a good one, that it can be traced who said what, but I think indeed that it’s more a problem that the students are too nice for each other, then that they are too harsh for each other, if I look at the population at our school.

Appendix I. Word webs



Appendix J. Starbusting



Appendix K. Expert Experiment Focus Group Questions

Giving feedback

- Did any of you encounter any problems during the giving of feedback, and do you want to see something changed?
  - Which of these things are deal breakers?

Receiving feedback

- Did you find the feedback overview sufficient, or do you want to see something changed?
- Was the feedback immediately visible for you when teaching?
  - Which of these things are deal breakers?

Extra features

- Do you feel like discussion via the chat on this platform is a helpful addition, or do you want to see something changed?
- Do you feel like a comparison of feedback to the authority figure helps you reflect on your own feedback, or do you want to see something changed?
- Do you feel like showing this summary of the feedback helps feed a discussion, or do you want to see something changed?
  - Which of these things are deal breakers?

General impression

- Did you feel like this was a full peer-feedback experience, or do you want to see something changed?
- Do you feel like this is a system that can be implemented in your class, or do you want to see something changed?
  - Which of these things are deal breakers?

Ask for upcoming experiments

- How do you see the role of the educator in such a feedback process?

Appendix L. Feedback criteria according to experts in the field

The following criteria were named by the interviewees:
- Aspects of didactic - Appendix D, E, F
- Did I differentiate enough (Was the class accessible for all students' skill levels?) - Appendix D, F, G,
- Did I get the attention of the students? - Appendix D, E, H
- Do the pupils tidy up the instruments after the class - Appendix D
- Do the pupils use their instruments correctly - Appendix D
- Own musical skills - Appendix D
  - Can I start or stop the group? - Appendix D
  - Do I know the difference between high and low pitch? - Appendix D, H
- The rubrics - Appendix E
- Is the activity/song chosen correctly, does it fit the target audience? - Appendix E, F, G
- It has to be prepared properly. - Appendix E, F, G
- It needs to fit in the allocated time. - Appendix F
- The balance between talking and playing. They don't need to just talk. - Appendix F
- That it fits in the vocal range of the children - Appendix G, H
- How do you make contact (verbally and non verbally) - Appendix H
- How do you talk (speed, openness, tone) - Appendix E, H
- What do I radiate? - Appendix E, H
- Can I make pace? - Appendix H
- Are my instructions clear? - Appendix H

Appendix M. Expert experiment focus group answers

Did any of you encounter any problems during the giving of feedback, and do you want to see something changed?
[Participant 1]: I did not have a problem during the giving of feedback, but I thought that if the time that the feedback is given is registered, that you want to give multiple answers per question on different times. I expected that I was able to submit an item of feedback per question, press submit and enter another one.
[Participant 2]: I would also like to be able to, in the timeline, comment multiple times per question.
[Participant 3]: I agree with them by the way, but you already knew that.

[Researcher]: Is this a dealbreaker?
[Participant 2]: At the moment that you have to make a choice, about a part, I do not think that you are doing justice to what that student was doing at that moment. Especially because they can look at the screen and see what the students have said, they can improve themselves based on this feedback, which will result in people removing this feedback. This means that this feedback is lost, and so is the improvement point.
[Participant 3]: Yes, for example, at the beginning of the class session you were not very auditable, but after a while you became more auditable, and you can make that discussionable this way.
[Researcher]: So you would get more of a timeline idea per question?
[Participant 1]: Yes, and it already is a timeline, which I really like. You can utilize this timeline even more by being able to submit a comment more often.

[Researcher]: Okay clear, but is it really a dealbreaker, does it function like this, or does it really have to change?
[Participant 2]: Yes, it does work but it does not do justice to the development of the presenting student during the session.
[Participant 3]: I can imagine that if you have the possibility to give feedback per moment, that wouldn't be a dealbreaker for me. The current functionality would still be nice, but then at the end of the session, you can give an overall opinion where this might be nice.
[Participant 1]: And the timecode, actually is not relevant anymore then.
[Participant 3]: No, it is not relevant anymore indeed. And also, we make a summary as teaching students, but it is also possible for the students to summarize what they thought of the session. That is exactly what that is then.

Did you find the feedback overview sufficient, or do you want to see something changed?
[Participant 1]: yes the overview was very clear. You see the questions and answers under each other.
[Participant 3]: You have to scroll a lot on the phone, you can not see the entire width of some elements so maybe you want to apply some scaling to that, that is what I experienced. During your class session (He is talking about the session of [Participant 1]), I was giving feedback on my phone, and I was told that I was not paying attention.
[Participant 1]: If you are in front of the class, I do not have time to read 7 or 8 things.
[Participant 2]: Yes actually, for the different criteria, you actually want some sort of thermometer, which will turn green or red, because then you can see real quick while teaching what is going on.
[Researcher]: There already are progression bars for the likert scale and yes/no questions. Do these

not fulfill this purpose?
[Participant 1]: Yes, that is true but it might be caused by not enough people giving feedback so they seem kind of static.
[Participant 2]: Yes that is it.
[Participant 1]: The interface for the teaching student should be a bit cleaner I think.
[Participant 2]: You do not have time to read.
[Participant 1]: And if you do it, then your attention is on the screen for 10 seconds.
[Researcher]: Are these dealbreakers?
[Participant 1]: Yes, because when you are in front of the class, you simply do not have time to read it.
[Participant 2]: Even when you only have two students who follow nicely,
[Participant 1]: Apparently when you are following the class, you do not even have time to give feedback because [Participant 2] was still busy after the sessions.
[Participant 3]: On the other hand, I had ample time to look at the device, when you were working ([Participant 3] did a class session where students had to work by themselves for a little time). So it can also be a helper to give varied classes and not just talk as the teaching student.
[Researcher]: I did have enough time to give feedback throughout all the sessions, but that might also be because I know the system.
[Participant 2]: I can type fast and blind, but apparently I was busy working on the assignment that [Participant 3] gave, and then we looped it.
[Participant 3]: You are thinking about what you write, and you want to do it carefully, and that can hinder the other process that you are in. So that is difficult
[Researcher]: Did you have a preference for a particular question? You now had the likert question, the open question, and the yes/no question.
[Participant 2]: The formulation of the question is very important, there was one question: “Is the attention of the entire class kept during the session”. This is a question that you can only fill in at the end.
[Participant 1]: But that is really specific about the question, you can adjust the questions later on ofcourse. But I think during the sessions the buttons are really nice, because then you can quickly give feedback, and the open questions are more for after the fact.
[Participant 2]: Yes you have to build time into the session, to argumentative your findings. I would do this argumentation in a later phase.
[Researcher]: So you want a solution with 2 screens, where the students can select buttons quickly in the first screen, and then after the fact they can add a textual argumentation in a second screen when the session is done, and the presenting student is summarizing their feedback.
[Participant 3]: Yes, that is nice.
[Participant 2]: At the moment that I’m writing, I’m not paying attention at the class session. And at the moment that the teaching student reads, they do not pay attention to the class session.
[Participant 1]: I think that a Likert scale question conveys more information then a yes/no question. It hardly ever is yes/no. Then a 4 point likert scale would be nice.
[Participant 3]: Yes, then they have to make a choice, do not stay on neutral
[Participant 1]: Exactly.
[Researcher]: The yes/no question is based on a rubrics of one, [Participant 1] I heard that you are looking into rubrics at the moment.
[Participant 1]: Yes that is true, but the rubrics of one works a lot more with written feedback.

Was the feedback immediately visible for you when teaching?
This was already discussed in the previous question, so due to time constraints this question was

skipped.

Do you feel like discussion via the chat on this platform is a helpful addition, or do you want to see something changed?
[Participant 1]: Yes… then you have to moderate a lot, it also depends on the class I think.
[Participant 3]: With a heart, I also get the tendency to do three hearts. No seriously, if you get these emoticons, then you get a whole lot of them. I then have a tendency to combine them or something.
[Participant 2]: For me it was a bit illogical to first choose an icon, and then being able to chat. I kept clicking on the chat bubble, because I wanted to chat but I was not allowed because I did not leave an icon as of yet, which was not clear to me. Maybe it's something, that when you know it, it makes sense. But I spent quite some time trying to send a message, but I couldn't do it, until you told me that I have to select an icon first.
[Researcher]: Yes the idea of this is, that emoticons are the quickest, and thus first way to communicate about the feedback. When one leaves an emoticon, the chat is opened, because if the chat is opened by default and everybody can just chat freely with one another, the entire class which may exist of 30 people will open a chat with the presenting student which is not manageable. Maybe the UI is better, when I do not display the chat icon, until one has left an emoticon.
[Participant 2]: Yes, maybe that is more handy.
[Participant 3]: I was also thinking, in such a simulation class setting, we did not finish the educator role. Because we are busy with an activity, the students gave feedback. After this the educator can draw conclusions and other things which we did not do. This might be interesting for a follow up test.
[Researcher]: yes, I left this out intentionally. This mainly has to do with the time constraints of this meeting. There are a lot more aspects of this platform which we do not test today, which we did not test. For this experiment I want to have a validation that the platform is working in the class sessions as intended.

Do you feel like a comparison of feedback to the authority figure helps you reflect on your own feedback, or do you want to see something changed?
[Participant 1]: I had a bit of a double feeling about this. On the one hand, it is really good that you can check if you agree with each other, on the other hand you do not always have to agree with each other. An educator is also not a know-it-all.
[Participant 2]: But a one-sided look is also bad.
[Participant 1]: That's why. So if you see that the feedback is not the same, what does the student do then? Are they going to reflect on it, or are they just going to copy the feedback of the educator blindly? So I do not know for sure what the effect of this is, so I do not know what I find of this.
[Participant 2]: But maybe that's because of what we do here at this school, the educator is not more right then the students.
[Participant 1]: Exactly that.
[Participant 3]: I can also imagine that you can be guiding in some ways to leave feedback in certain ways at certain times to make a focus point, to tell the students: "This happened at this time", so that they can talk about it.
[Participant 1]: And that is really important, the talk after the session. And that can be a physical talk, but it can also be an online talk. Which might be nice for online lessons.
[Researcher]: The idea for the discussion at the moment, is that you also write a summary, and then you can discuss based on this summary. I found in my interviews that everyone almost always misses something in their feedback. By discussing it at the end you merge the most important feedback so that the entire class learns from it. So it can also be done online via the chat, but then you might miss

that aspect.
[Participant 1]: You can use it really nicely for other forms of assessment, like portfolio support. Especially because it's all saved. So it's really nice to save it somewhere.

Do you feel like the summary of the feedback helps feed a discussion, or do you want to see something changed?
[Participant 2]: I think that it is really nice that a student summarizes it in 150 characters, because I think that this will help them remember the core of the feedback that has been given to them. It is some sort of cheat sheet, which I always allow in my classes, because the student always remembers what they have written down on it, especially because they had to write it down as compactly as they did there.
[Participant 3]: I think this is really strong, beforehand I was really curious how I would experience this, but it actually was really simple. I found it really easy to write a simple summary from the feedback that I've gotten.
[Participant 2]: This is easier to do when only two people give feedback, but it might be more challenging when a full class is giving feedback.
[Participant 3]: I'm also curious about this.
[Participant 1]: It is also the question, if you do this in a class session if you want everyone to give feedback, or if you want to task two or three people with giving feedback. I hope with this summary that students are not jumping into a defensive position, because there are a couple of students, of whom I already know that they will only say "yes but, yes but" en then…
[Participant 3]: Some people might also find it scary to write something because they might not be too popular in the class, so I'm asking myself if you should share this with the class, or if this is the summary which just is for the educator, and the presenting student.
[Researcher]: Yes, that is done with the same reason as why the educator's feedback is compared with it, so that people can see if they had the main gist of the feedback. But this is also the question, how effective is this.
[Participant 1]: Maybe this summary should be visible for just the educator then and not for everybody, because this also is a reflection of a personal progression.
[Participant 3]: If you want to have a short summary to compare to the given feedback, then you could also say that the educator has to write a short summary. But then you assume again that the educator is always right which is not per se the case.
[Participant 1]: That does not have to be, because as an educator you did see all the feedback of all the students, so you do have an overview so the educator should be able to write a better summary then the students.
[Participant 3]: How nice would it be if it then is AI that does this for you, it saves you a lot of time.

Did you feel like this was a full peer-feedback experience, or do you like there is something missing?
[Participant 1]: Yes, the feedback discussion was missing. You do not have any grip on the processing of feedback with this tool.
[Participant 3]: What do you mean by that?
[Participant 2]: What was said and what can I do with this?
[Researcher]: These are the learning goals for example. What can you improve?
[Participant 2]: Or when someone totally disagrees. That is also possible.
[Researcher]: That is what the chat is currently for.
[Participant 2]: Yes, but the question is if you are going to get long discussions in this chat, but you can

also just have a chat based on what was just said in the feedback session. But then it is not saved.
[Researcher]: And you also have to think about the time spent in the class.
[Participant 2]: I think that the combination is really good with this tool, and a talk after.
[Participant 3]: Give an overview, and then have a talk after, about its contents.
[Participant 2]: Yes, yes, and maybe at the end of such a talk, a summary can be created, where the educator and the student both say, this is what is achieved. I'm missing the final conclusion.
[Participant 1]: I'm having some doubts now about the comment functionality, what it adds. How practical it is. Because during a class session, you are not going to chat with everyone.
[Researcher]: It is also made for after the class session.
[Participant 2]: Ooooh, but I thought no one was able to access the session after the educator had ended it.
[Researcher]: No, you are still able to chat. And also in the navigation, you can see a chat icon next to your name. And when you have unread messages, it lights up there, and you can read your chats. That way you can keep up with the chat. So that is the thought behind it, that you can take a part of the discussion out of the class so that you can save time during the class session.
[Participant 3]: What I do ask myself is how much of the session do you remember if this chat is happening a while after the session. Then you would need a video function.
[Participant 1]: That would be great. If you can connect this with IRIS Connect, then you are there right? Do you know IRIS Connect?
[Researcher]: I've seen it quickly. That is that video feedback platform right?
[Participant 1]: Yeah if you combine it with video then it is perfect right? Then you can exactly connect the feedback to the video and the person can see what and when something happened.
[Researcher]: So it is not a problem for you to set up a camera in the class and record it?
[Participant 2]: It is just an app on your phone.
[Researcher]: But that is for you not a problem, and it also complies with privacy laws?
[Participant 2]: Yes you can record it like it is a cartoon, where you can not recognize anyone. But you also of course have to watch the scope of your project.
[Participant 1]: You can also ask the student to record it with their own phone for personal use. Then you start the recording at the same time, and then you know which feedback has been given when.

Do you feel like this is a system that can be implemented in your class, or do you want to see something changed?
[Participant 2]: I would really use it like, let's give feedback on each other, I would use it less as a platform where a discussion takes place. But I would show the collection on the beamer, and that is what we are going to talk about during the intervision moments. But what I really like is that it is user friendly, students can give information quickly, if it's only with buttons it would be fine too, and then in a shared moment continue with the information acquired. What I really like is that the teaching student can see if they are doing well, so that they can rectify mistakes. Because the ability to correct life is really important. We like to teach the same classes right after each other, because then we can point out the mistakes of the previous class in the next one so that they can immediately think about them. The upside of this system is that you can correct yourself in real-time.
[Participant 1]: I totally agree with this, if you use it for a feedback conversation is good, but if it is asynchronous, after the session, I do not know if it's going to be used a lot. Then you almost have to oblige the class to make a certain amount of comments. That does not work.
[Participant 2]: Everyone has their own opinions. Just let them think about something, The student should read it, and then they do not have to justify what was said, or agree with it. This is what it is, good luck with it.

[Participant 3]: And what if nonsens feedback is given?
[Participant 1]: Then that is the case.
[Participant 2]: Then the student thinks, this is nonsense. But it can also be really good feedback, that the respondent thinks, this is nonsense. You would also need to set up some borders for the students. Like no cursing. Behind a computer screen the students can be a bit more intense.
[Participant 3]: Especially because it is anonymous. But the educator can always see who has given the feedback.
[Researcher]: And it is also the case that the feedback is not shown in front of the class, so the presenting student is the only one who sees it. Besides that only the summaries are published to the students, which is not in consideration. But in a chat, one on one, you do not know who you are chatting with.
[Participant 1]: Yes but in a class with 30 persons, they will know it soon enough.
[Researcher]: Yes they will discover it soon enough, but such a chat won't last for a week.
[Participant 1]: No, that is not what you hope.
[Researcher]: But you are right, that this is definitely something that is worth testing.

What does the role of the educator in such a feedback system look like for you?
[Participant 1]: yes that is the moderator, so they want to monitor and eventually delete given feedback. When students start doing weird stuff, it is just click, and gone. Especially during the class sessions, they should be the ones who decide what is going to be put on the screen. Also for the information overload. What I would love is that I can just see one quick word on the screen in red or green, this is what is going well, and this is what is not going well.
[Participant 3]: I've also already tested this with students here, with a prototype where the screen is only lit on when feedback is given. When you only have a max of 5 words, you are reasonably fast at reading it. Then it will cost them the least distraction and the least amount of effort.
[Researcher]: So the educator makes a selection of what feedback the students sees whilst they are presenting, so when the session is done, you get the feedback report. Should they see all the feedback there, or just what the educator has shown them during the active class session.
[Participant 1]: No, everything. Then you have enough time to look at it. It is purely about the information overload.
[Researcher]: So the educator should see all the feedback that is given, have a forward function to send it to the presenting student, and have a delete function to avoid that it is being sent to the report, if the feedback is malicious, or not good for the student to see. And then what is left over, gets all put into the feedback report.
[Participant 3]: Now we have had a really short activity, but what if you have an activity which lasts for 15 minutes, or maybe even an entire class session, then you get a whole lot of feedback, and if you have to moderate that might be something too.
[Participant 1]: Yes, but you do not have to press the button every minute. If you know that an activity is longer, you are likely to give less frequent feedback.
[Participant 3]: Yes, and maybe the moments that something is really happening, and then you see a cloud in the feedback timeline, then you know that something is up.
[Participant 3]: Are there things that you miss in this system?
[Participant 1]: What the icons mean.
[Participant 2]: What the thumb up, hearth question mark, check mark, is it agree, do not agree, I've seen it.. What does it mean?
[Researcher]: It does not do anything, it just shows the icon to the other person, so maybe I've to make this more clear. The only thing that it means, is what the person who sent it meant by it, and what the

person who received it adjusted it and thus might change over different feedback.
[Participant 2]: But for example, the check icon can mean all kinds of things, I've seen it, I Think it's good.
[Participant 1]: Maybe it is nice to add a legend, so that it is clear what means what, especially if you use this in different classes with different educators.
[Researcher]: I think that this adds a bit too much complexity for such a simple addition. There are a lot of different applications like whatsapp, facebook, and everyone connects their own similar meaning and interpretation to them, and when you are going to lock these things in and assign a specific meaning to them, you higher the learning curve for using the system, since everyone has to learn what the icons mean before they can use them directly.
[Participant 2]: That's right, then you have to remember what they all mean.
[Participant 1]: But when you hover them, you can maybe show it.
[Researcher]: But then you get that one person does know what it means, whilst the other person has not hovered it and does not know what it means. I think that a thumbs up is a thumbs up, and we should not make it more than what it actually is.
[Participant 1]: Then I do not really see what these icons are doing there. When this tool is a formal tool that you use within an educational setting, then I would like to have a meaning added to certain effects.
[Researcher]: I get that, but do they then have to be icons?
[Participant 1]: I do not know, that is what they are at the moment.
[Participant 2]: Yes, and that is why I might think that there are too many. Yes, or no.
[Researcher]: Okay, would it be better if we limit the amount of icons to just a thumbs up, a thumbs down, and a question mark in order to reduce ambiguity so that it would be clearer what they actually mean?
[Participant 1]: Yes, that might be better.

Appendix N. Feedback analyzation form (Created by graduation supervisor)

Feed-up		
Waar werkt de student naartoe?	1. Dit is het beoogde leerresultaat/leerdoel:	
	2. Zo verheldert de docent leerdoelen:	
	3. Dit zijn de criteria voor succes:	
	4. Zo deelt de docent de criteria voor succes:	
	5. Zo borgen we dat de student de leerdoelen en criteria begrijpt:	
	6. Daarin hebben de (mede)studenten de volgende rol:	

Feedback		
Waar staat de student nu?	7. Hierover wordt gediscussieerd:	
	8. Zo realiseert de docent effectieve discussie:	
	9. Dit bewijst dat er is geleerd (hoe ziet dat eruit?):	
	10. Deze activiteiten realiseeert de docent om het leren te bewijzen:	
	11. Zo activeren we studenten om als informatiebron voor elkaar te dienen:	
	12. Dit willen we zien m.b.t. eigenaarschap:	
	13. Zo activeren we studenten in het stimuleren van eigenaarschap over het eigen leren:	

Feed-foward		
Hoe komt de student bij de gewenste situatie?	14. Hier gaan we terugkoppeling over geven:	
	15. Dit zou het volgende leren moeten zijn:	
	16. Zo geeft de docent de terugkoppeling op verder leren:	
	17. Zo activeren we studenten om als informatiebron voor elkaar te dienen:	
	18. Dit willen we de volgende keer zien m.b.t. eigenaarschap:	
	19. Zo activeren we studenten in het stimuleren van eigenaarschap over het eigen leren:	

Appendix O. Questions survey design phase 3 (Created by graduation supervisor)

Question	Question type
Wat is jouw gebruikersnaam voor het inloggen in de technologie? (zie oranje strookje, bijvoorbeeld 157-kpz)	Open
Op welk device heb je met de technologie gewerkt?	Multiple choice
Hoe sta jij tegenover het gebruik van apps en websites voor het leren in de opleiding? 1= Heel negatief, 5= Heel positief	Multiple choice
Wat van deze les heeft vooral bijgedragen aan wat jij hebt geleerd? Maximaal 3 keuzes.	Multiple choice
Op welke manier heeft de technologie bijgedragen aan wat jij deze les hebt geleerd?	Open
Hoe makkelijk heb jij kunnen werken met de technologie? 1= Helemaal niet makkelijk, 5= Heel makkelijk	Multiple choice
Hoe tevreden ben jij met hoe de technologie is toegepast in de les? 1= Helemaal niet tevreden, 5= Heel tevreden	Multiple choice
Licht de keuze die je bij 3c maakte toe.	Open
Wat kan/moet volgens jou eventueel anders, zodat jij de leerdoelen nog beter kunt behalen?	Open
Wat kan/moet volgens jou eventueel anders om het geven, ontvangen en leren van feedback te optimaliseren?	Open
Wat kan/moet volgens jou eventueel anders, zodat de technologie beter wordt benut?	Open
Wat kan/moet volgens jou eventueel anders, zodat je beter wordt ondersteund door de technologie en zodat je daarmee beter leert?	Open
Welke tips heb je nog voor de ontwikkelaars van de technologie en voor de ontwerpers van de les?	Open

Appendix P. Analysis KPZ student interviews with survey answers

These are the analyses made from the KPZ interviews, together with the surveys that these students have filled in. This allows connections to be made between the surveys, and the answers that are given by the students.

Takeaways interview 8-kpz (Class 1)

Survey answers:
Hoe sta jij tegenover het gebruik van apps en websites voor het leren in de opleiding?
1= Heel negatief, 5= Heel positief
3
2. Wat van deze les heeft vooral bijgedragen aan wat jij hebt geleerd? Maximaal 3 keuzes.
De correcte voorbeelden door de opleider, Het zelf oefenen in groepjes, Het zelf oefenen voor de klas
3a. Op welke manier heeft de technologie bijgedragen aan wat jij deze les hebt geleerd?
Na mijn mening vrij weinig, dit had ook gewoon besproken kunnen worden
3b. Hoe makkelijk heb jij kunnen werken met de technologie?
1= Helemaal niet makkelijk, 5= Heel makkelijk
3
3c. Hoe tevreden ben jij met hoe de technologie is toegepast in de les?
1= Helemaal niet tevreden, 5= Heel tevreden
2
3d. Licht de keuze die je bij 3c maakte toe.
Het werkt naar mijn idee alleen maar afleidend, je bent meer met je telefoon bezig dan de echte les
4a. Wat kan/moet volgens jou eventueel anders, zodat jij de leerdoelen nog beter kunt behalen?
Zonder technologie is beter, echt oefenen en uitspreken wat je vind lijkt mijn beter
4b. Wat kan/moet volgens jou eventueel anders om het geven, ontvangen en leren van feedback te optimaliseren?
-
4b. Wat kan/moet volgens jou eventueel anders, zodat de technologie beter wordt benut?
Naar mijn idee niet overal technologie inzetten
4b. Wat kan/moet volgens jou eventueel anders, zodat je beter wordt ondersteund door de technologie en zodat je daarmee beter leert?
-
5. Welke tips heb je nog voor de ontwikkelaars van de technologie en voor de ontwerpers van de les?
Makkelijker om te gebruiken

Sentiment of the survey

Although she says that she is not really opinionated about using apps and websites for learning, she finds the technology redundant and thinks that giving feedback verbally is a better solution, since being on your phone can be distracting. She says later on in the survey that technology should not be used everywhere.
For an improvement of the platform she says that it should be easier to use.

Takeaways interview

The goal of the class was learning how to lead a song. The interviewee did not have any prior knowledge of this subject. She learned during this session mostly by doing, and looking at the other people in the class and noticing what is missing. She liked the exercise where they had to practice in smaller groups. After the class session she feels fairly confident that she can lead a song. She finds it more difficult to practice before her internship class than for her real class.

She says that the educator teached the class really nicely and the lesson structure was fun as usual with this educator, but she does not really like the technology. She got distracted by her phone and started looking at other apps during this session when she gets notifications. This takes her concentration away from what is happening in front her. Usually the music classes are taught with a no phone policy. That might also have to do with security. If you perform in front of a class, maybe someone might make a video if everyone is holding a phone. A possible solution for this might be to do it on a laptop or an Ipad but it is something to think about.

I did not really think that the app had a lot of added value. It is a new app, so it is a bit slower and stuff. The app was slowing down the lesson. This might also be because it was the first time that everyone has to get to know how it works “The researcher agrees with this statement”. She did not like the negative feedback that was given in the likert scale. The idea that 10% of the class might think that you are not doing the exercise well. Of Course you have positive things, but every person also looks at the negative things, and these things tend to stick more. It already is quite a step to perform in front of a class, and what if it did not go well? Then you have a list of negative feedback of which I can imagine that it will make you feel bad.

I have encountered formative feedback, also via the app. I know about this class that everyone gives positive feedback which is nice to see, and to get but I do not know if this is the case for every class. I think it gives you a good boost when everything goes well and you get positive feedback. A positive of giving feedback with the tool is that everybody can give feedback which would usually not be possible. At the end when everybody knew how it worked, it went quicker and then you had all the feedback in a list.

I think that the technology did not really help with the learning. The learning is mostly repeating, doing things on your own. I do not think that the technology added a lot during this session. The thing the technology helped her most with were the steps (multiple choice question), that you can see what is missing. This might have the effect that you are more conscious about it. But the info that is missing is also displayed on the digiboard so it is a bit difficult to say something about that.

I’m not really a fan of technology during the class session, it might be that some people really like it. I’m easily distracted, and other people are too. You get a lot of notifications. This might be less on a laptop, but you still get emails or can play a game. What might work is that you wall off the other websites so that they can only access this one, just like during exams. “The researcher says that you can tell the class to put your devices in focus mode”. She questions if everyone is going to do that. “The educator jumps in; if you know that you are easily distracted, you can do that whilst other people might not mind.”.

I liked the idea of the app, and the design was clear. I like that different things are tried in education. It might work really nicely in the next class.

Conclusion
Kpz-8 is hesitant of technology being used to teach. She gets easily distracted by her phone, especially when getting a notification. These distractions take her attention away from the class which is the opposite effect of what we want. Also the long load times are a dealbreaker for her since they cost valuable lesson time. She also sees a possibility that having phones in the classroom might result in people recording other people's performance which is a serious security risk. She also has a preference for positive feedback. She believes that having negative feedback, even though 90% might be positive, has a big impact on how a person might feel. She also mentions that it might increase stage fright, because you have the pressure of the feedback being logged.

Possible solution
It might be a good idea to look into using laptops to give feedback. This way people can not record in the class, and it decreases the amount of pop-ups that the students get. She mentioned that laptops still might be distracting, because people can play games on them, or receive emails but the assumption can be made that the distractions will be less impactful then when using a phone which has these two possibilities alongside other distractions like text messages. This will also speed up the feedback giving process since it is expected that the site is more user friendly on a computer. This however should be researched more in the future.
She was also worried about negative feedback. In an ideal scenario all the criticism is constructive, but that is simply not possible when giving feedback through a yes/no or a likert scale question. This is why extra attention should be given to designing likert and yes/no questions in a way that they can not have a big negative impact.
The long loading times are easily fixed by getting faster servers, or letting less people give feedback at once.

Takeaways interview 35-kpz (Class 2)
Survey answers:
Hoe sta jij tegenover het gebruik van apps en websites voor het leren in de opleiding?
1= Heel negatief, 5= Heel positief
3
2. Wat van deze les heeft vooral bijgedragen aan wat jij hebt geleerd? Maximaal 3 keuzes.
De correcte voorbeelden door de opleider, De foutieve voorbeelden door de opleider, Het zelf oefenen in groepjes, Het meezingen tijdens het lied leiden door iemand anders, Het feedback geven op iemand anders, Het ontvangen van feedback, Het praten over de feedback, De ondersteuning door de opleider
3a. Op welke manier heeft de technologie bijgedragen aan wat jij deze les hebt geleerd?
Ik vond het geen meerwaarde voor de les. Ik wrrd er meer door afgeleid
3b. Hoe makkelijk heb jij kunnen werken met de technologie?
1= Helemaal niet makkelijk, 5= Heel makkelijk
3
3c. Hoe tevreden ben jij met hoe de technologie is toegepast in de les?
1= Helemaal niet tevreden, 5= Heel tevreden
2
3d. Licht de keuze die je bij 3c maakte toe.
Het werd soms een beetje storend om te moeten wachten op het laden en de antwoorden op een medestudent
4a. Wat kan/moet volgens jou eventueel anders, zodat jij de leerdoelen nog beter kunt behalen?
Pas

4b. Wat kan/moet volgens jou eventueel anders om het geven, ontvangen en leren van feedback te optimaliseren?
Feedback gegeven in de groepjes ook bespreken en de docent kan de volgende keer bog beter benadrukken waar er op gelet moet worden bij het geven van feedback. (Geen negative feedback enz.)
4b. Wat kan/moet volgens jou eventueel anders, zodat de technologie beter wordt benut?
Sneller en vloeiender achter elkaar benutten.
4b. Wat kan/moet volgens jou eventueel anders, zodat je beter wordt ondersteund door de technologie en zodat je daarmee beter leert?
Geen afleiding. Dus een vraag invullen en dan klaar. Niet op tafels laten liggen enz.
5. Welke tips heb je nog voor de ontwikkelaars van de technologie en voor de ontwerpers van de les?
Ontwikkel een app. Niet via een site. Zorg ervoor dat alle browser dit ondersteuen

This interviewee has a neutral stance opposed using technology in enhancing learning in education. He did not see a real benefit since he was easily distracted by the technology, he thinks that the phone should not be left on the table. He also found the loading times to be troublesome, there needed to be more pace when using the system. He thinks that the educator should put more emphasis on what kind of feedback should be given, like no negative feedback.
He would prefer an app over a website, it is not clear why. He emphasizes that browser support should be good which makes it assumable that someone had trouble running the application.

Takeaways interview
The interviewee does not have a lot of musical experience. He has trouble indicating the beat of a song, which he did improve upon in today's lesson.

I've learned a lot of valuable steps, like how to indicate the beat and how important this is to do. He mainly learned this through the practice in groups, which is less stressful then practicing in front of the entire class. It also helps to experience the lesson, instead of having just the theoretical information.

I thought the lesson was nice, with a lot of repeating which was nice. What he did not like was that they had to fill in a lot of questionnaires (The giving of feedback) through their phones. He thinks it is better if there is just one big questionnaire which you fill in at once. This will decrease the amount of interruptions being made for giving feedback.
Another problem that occurred was that during the session where a couple of students were tasked with giving feedback whilst the other students were following the class session. When this feedback was discussed, the feedback criteria and was filled in, was not clear for the people who followed the class session so it was difficult to discuss. He would prefer it if everybody gave feedback.

He would use the phones less, like one or two times during a class session so that is not required to have your phone on your table for the entire class session because then your browser can get stuck, and it gets easy to switch to a different tab with something like instagram.

I think that the suggested answers in the open questions are really nice for when you do not know what kind of feedback to give.
I have not received feedback myself, but I think that the idea of receiving feedback whilst teaching is really nice, but I also think that it can be a distraction. I think that making a small mistake along the way might not have as much an impact as someone looking at an ipad and losing the students during

the class session. “The researcher: But what if the screen is off most of the time and only turns on when feedback is given?”. Yes that would be better indeed.

The technology helped a lot when the teacher was in front of the class giving an example and we had to reflect on what she was doing. Reflecting on the missing steps was really helpful.

You need to make sure that it works on every browser. Also now we are with a lot of students which slowed down the application which slowed down the lesson. This is distracting for students.
Takeaways interview 42-kpz (Class 2)

Survey answers:
Hoe sta jij tegenover het gebruik van apps en websites voor het leren in de opleiding?
1= Heel negatief, 5= Heel positief
3
2. Wat van deze les heeft vooral bijgedragen aan wat jij hebt geleerd? Maximaal 3 keuzes.
De correcte voorbeelden door de opleider, De foutieve voorbeelden door de opleider, Het meezingen tijdens het lied leiden door iemand anders
3a. Op welke manier heeft de technologie bijgedragen aan wat jij deze les hebt geleerd?
Niet Perce heel erg veel
3b. Hoe makkelijk heb jij kunnen werken met de technologie?
1= Helemaal niet makkelijk, 5= Heel makkelijk
2
3c. Hoe tevreden ben jij met hoe de technologie is toegepast in de les?
1= Helemaal niet tevreden, 5= Heel tevreden
3
3d. Licht de keuze die je bij 3c maakte toe.
Niet slecht maar ook niet heel erg goed. Vind het een beetje lastig om daar een mening over te hebben.
4a. Wat kan/moet volgens jou eventueel anders, zodat jij de leerdoelen nog beter kunt behalen?
Eigenlijk niks vind zoals het gaat al prima
4b. Wat kan/moet volgens jou eventueel anders om het geven, ontvangen en leren van feedback te optimaliseren?
Feedback niet via een apparaat maar echt tegen elkaar zeggen. Vind het nu iets onpersoonlijker.
4b. Wat kan/moet volgens jou eventueel anders, zodat de technologie beter wordt benut?
Ik vind niet perse dat technologie er in toegepast moet worden
4b. Wat kan/moet volgens jou eventueel anders, zodat je beter wordt ondersteund door de technologie en zodat je daarmee beter leert?
Niks eigenlijk
5. Welke tips heb je nog voor de ontwikkelaars van de technologie en voor de ontwerpers van de les?
Ik vind zelf dat er niet perse technologie nodig is tijdens een muziekles

She finds the technology to be a disruption of the class. She finds that technology is not needed in a musical class.

Takeaways interview
I learned the entire process of leading a song with all its steps. I can start a song, how to highlight the pitch and how to signal the beat. The examples that were given really helped. It was helpful that it was

shown to us how it should be done. Doing the actual teaching in the groups after was a bit thrilling. It is easier to do this in front of kids.

I liked the class session, but the phone was a bit distracting for me. I would prefer it if it is the normal class session. The examples helped her more than the feedback. Feedback is nice but quickly throughout the session.

The technology did not really help me with the giving of feedback. It was more of a distraction for me. I was less focussed on the lesson itself than I was without the tool. I was paying more attention during the session because I was tasked with finding missing things whilst teaching but this could also have been written on the digiboard.

A possible improvement could be that you only use your phone between sessions quickly, but not during the exercise. During the singing I wanted to give feedback, but that did not work at once.

I don't think that it's needed, technology in the musical classes. I think it is redundant. Music should be something personal, and not on your phone. The feedback should be said verbally in the class so that you can learn from each other's feedback too.

Summary
She was very critical of technology being used during a musical class. She found the phone to be distracting especially during an activity. She had difficulties giving feedback whilst following the activity and thinks that the feedback should be given between sessions, not in action. She finds that there are other better alternatives for doing these exercises.

Takeaways interview 56-kpz (Class 2)

Survey:
There was no survey found for this account.

Takeaways interview

During practice sometimes I went with the rhythm instead of the beat, but during practice I improved on this in front of the class. Mainly the receiving feedback helped me to improve on this. Before the class I also had difficulties with starting a song which I really learned during this class session. The explanations of the educator helped me to learn this.

I liked the example at the start of the lesson, because it lets you know what to expect. I like that you get a lot of feedback, because it lets you learn. What I do not like is that it is given on a phone. I would only use the technology when the session is done. I did not like it when I was in front of the class and everyone was on their phone doing something quickly.

It was nice to have feedback criteria, because that lets you know what to pay attention to. It forces you to answer it too. When receiving feedback, it was nice to get it in a bigger quantity.

Summary
She was quite neutral about the technology. She thought it was nice that it lets you gather bigger amounts of information, but she also thought that it was more distracting because people were on their phones during the class session.

Takeaways interview 63-kpz (Class 3)

Survey answers:

Hoe sta jij tegenover het gebruik van apps en websites voor het leren in de opleiding?
1= Heel negatief, 5= Heel positief
4
2. Wat van deze les heeft vooral bijgedragen aan wat jij hebt geleerd? Maximaal 3 keuzes.
Het zelf oefenen in groepjes, Het meezingen tijdens het lied leiden door iemand anders, Het feedback geven op iemand anders
3a. Op welke manier heeft de technologie bijgedragen aan wat jij deze les hebt geleerd?
Het geven van feedback
3b. Hoe makkelijk heb jij kunnen werken met de technologie?
1= Helemaal niet makkelijk, 5= Heel makkelijk
5
3c. Hoe tevreden ben jij met hoe de technologie is toegepast in de les?
1= Helemaal niet tevreden, 5= Heel tevreden
5
3d. Licht de keuze die je bij 3c maakte toe.
Het ging heel makkelijk
4a. Wat kan/moet volgens jou eventueel anders, zodat jij de leerdoelen nog beter kunt behalen?
-
4b. Wat kan/moet volgens jou eventueel anders om het geven, ontvangen en leren van feedback te optimaliseren?
Nvt
4b. Wat kan/moet volgens jou eventueel anders, zodat de technologie beter wordt benut?
Zorgen dat alle apparaten hetzelfde reageren/werken
4b. Wat kan/moet volgens jou eventueel anders, zodat je beter wordt ondersteund door de technologie en zodat je daarmee beter leert?
-
5. Welke tips heb je nog voor de ontwikkelaars van de technologie en voor de ontwerpers van de les?
Zorgen dat alles goed aansluit op elkaar

The interviewee was very positive about the technology. She thought it was really easy to use. The only improvement that she mentioned is that the application should work the same on every device which might imply that they encountered some errors on some devices.

Takeaways interview
I learned a lot throughout this class session, especially with the feedback we were more aware of what I did do, what I can improve and how I can give feedback to other people.

All the teaching material was new today. After the class session I was able to start a song, which is helpful for my implementation of my own lesson. I learned most from the repeating, the examples that were given, that we had to do it ourselves. I liked during this class that we practiced with different songs that we already knew.

I think that the feedback that we had to fill in with the tool was the most helpful. It made us aware of what we were doing and what could be done better.

The technology was nice because you have suggested answers. This means that you do not have to come up with an entire answer yourself. (Might imply the multiple choice questions or the tags under the open questions). The repetition with the technology was really helpful for me. I myself would've never come up with this. The thing that made me think most was the giving of open feedback when a classmate was in front of the group. You were able to combine your answers then which was nice.

The addition of technology was not disturbing at all. It was really nice. Filling in something now and then really helped me to stay focused on the class session. The amount of feedback given was perfect, it was not too much but also not too little.

Conclusion
She did not find the technology to be disturbing at all. It had the opposite positive effect on her and kept her more focussed on the class session. This might be caused by the change in the lesson structure where students logged in and loaded the pages beforehand so that they did not have to wait as long. It also might differ per person. She also filled in on the survey that she has a higher acceptance of technology in the class which might be why she did not see her phone as a distraction. She was really positive about the feedback and the implementation. Especially with the multiple choice questions.

Takeaways interview 103-kpz (Class 4)

Survey answers:
Hoe sta jij tegenover het gebruik van apps en websites voor het leren in de opleiding?
1= Heel negatief, 5= Heel positief
4
2. Wat van deze les heeft vooral bijgedragen aan wat jij hebt geleerd? Maximaal 3 keuzes.
De foutieve voorbeelden door de opleider, Het ontvangen van feedback
3a. Op welke manier heeft de technologie bijgedragen aan wat jij deze les hebt geleerd?
De vragen zijn wel fijn omdat dit ook in de realiteit te gebruiken is en niet alleen theorie zoals met wat mist er?
3b. Hoe makkelijk heb jij kunnen werken met de technologie?
1= Helemaal niet makkelijk, 5= Heel makkelijk
4
3c. Hoe tevreden ben jij met hoe de technologie is toegepast in de les?
1= Helemaal niet tevreden, 5= Heel tevreden
5
3d. Licht de keuze die je bij 3c maakte toe.
Het werd goed gebruikt
4a. Wat kan/moet volgens jou eventueel anders, zodat jij de leerdoelen nog beter kunt behalen?
-
4b. Wat kan/moet volgens jou eventueel anders om het geven, ontvangen en leren van feedback te optimaliseren?
-
4b. Wat kan/moet volgens jou eventueel anders, zodat de technologie beter wordt benut?
-
4b. Wat kan/moet volgens jou eventueel anders, zodat je beter wordt ondersteund door de technologie en zodat je daarmee beter leert?

-

5. Welke tips heb je nog voor de ontwikkelaars van de technologie en voor de ontwerpers van de les?

-

She did not fill in a lot of the questions but she was positive about the use of the technology and its implementation.

Takeaways interview

I learned the steps for leading a song. Repeating what I have to do and repeatedly saying what is missing so that you really clearly know what is expected of you. Doing this in groups of four was really nice, because it is a bit more secure and then I dare to do it. It was nice to have an example before and after this group session (before was given by the educator and after was given by another student). I think this first example given by the educator was the most important factor of the class session for me to know what is being expected.

Singing in front of a class was new for me. In the previous semester we were mostly learning about beats and rhythm.

The feedback helped me see what could be improved and what can happen. Also when you start trying it on your own it is nice to see where you can improve. The giving of feedback helped me think about what is happening. You have to fill in something, so you are looking more consciously at the moment because you know that you have to answer questions about it later on. Giving the feedback really required me to think.

I think the design of the class session was nice. You also get to do things yourself which is nice. I think that helps you to keep your concentration. The different examples of other students were also really nice to see. The repeating of the missing steps was really helpful. It helped give insights on what goes wrong when something is missing.

I think that the way the technology was implemented was good. At the beginning it was a bit chaotic, because people did not know what was going to happen. You were not able to see if it was correct or not. It might be nice to create an automatic system that can check this, and maybe work with points or something. It felt a bit like a survey that you were filling in. When you are wrong on something you can just change it. I liked the lesson, it was something different.

Conclusion

She likes the session and thinks that the addition of giving feedback helped her reflect. She also has a higher technology acceptance according to the survey, and did not mention that it was distracting just like the previous interview. She thought that the giving of feedback was a bit boring like a survey, and she would like to see if her given feedback was correct.

Takeaways interview 121-kpz (Class 5)

Survey answers:

Hoe sta jij tegenover het gebruik van apps en websites voor het leren in de opleiding?

1= Heel negatief, 5= Heel positief

3

2. Wat van deze les heeft vooral bijgedragen aan wat jij hebt geleerd? Maximaal 3 keuzes.
De correcte voorbeelden door de opleider, Het zelf oefenen in groepjes, Het ontvangen van feedback
3a. Op welke manier heeft de technologie bijgedragen aan wat jij deze les hebt geleerd?
Je kunt tijdens de les iemand feedback geven. Hierdoor kan je het makkelijker na de tijd bespreken.
3b. Hoe makkelijk heb jij kunnen werken met de technologie?
1= Helemaal niet makkelijk, 5= Heel makkelijk
5
3c. Hoe tevreden ben jij met hoe de technologie is toegepast in de les?
1= Helemaal niet tevreden, 5= Heel tevreden
4
3d. Licht de keuze die je bij 3c maakte toe.
Ja het is prima en overzichtelijk. Je kunt elkaar makkelijk feedback geven op verschillende onderdelen. De reden voor een 4 is omdat je dit na de tijd meteen kan bespreken. Het is makkelijk maar kan ook gewoon door te praten of op papier.
4a. Wat kan/moet volgens jou eventueel anders, zodat jij de leerdoelen nog beter kunt behalen?
-
4b. Wat kan/moet volgens jou eventueel anders om het geven, ontvangen en leren van feedback te optimaliseren?
-
4b. Wat kan/moet volgens jou eventueel anders, zodat de technologie beter wordt benut?
-
4b. Wat kan/moet volgens jou eventueel anders, zodat je beter wordt ondersteund door de technologie en zodat je daarmee beter leert?
-
5. Welke tips heb je nog voor de ontwikkelaars van de technologie en voor de ontwerpers van de les?
-

He was positive about the technology. It was nice to use it to feed a discussion but he does not see the real added value over doing this with a pen and paper.

Takeaways interview
When getting the music subject I prefer to not be the first one to do something because I run into a hurdle. It is getting better and better but this is why I did not lift my hand up the first instance that an educator asked a question.

I learned a lot from seeing other people execute the exercise. When someone else does it I think, I can do that too. Also doing it yourself was really helpful for me.

Beforehand we practiced a lot with rhythm so that went really well. I did have some troubles with the pitch, especially with the higher ones since I have a low voice but I practiced with this. I improved on this during the class session. Mostly practicing has helped me learn this. Also a practicing exercise where you move up a ladder of notes has helped me learn this. Repeating this every class session is very helpful for me.

I think that the design of the lesson was good. They presented a clear step based approach which you can see coming back. I liked that you could practice yourself so that you are not only listening. It might

be nice to make the part where one student is in front of the entire class a bit longer but that might not be possible due to time constraints. I would not mind being in front of the class in this setting too. You get the feedback, so you get some good points that you can use during your internship which is nice. I think it is a hurdle for a lot of people in our class to go first with sessions like this one where you are in front of the class.

What helped me a lot was the example at the beginning of the class where something was missing, and that you can select the missing items on the website. This helps you see later on what you've forgotten and what you still have to practice on. It is also nice for the presenting student to get pointers so that they can use it in their next sessions.

I like the implementation of the technology. It was easy to get on the website, and it was straight forward which was nice.

Appendix Q. Feedback analyzation form for activity 1 (Created by graduation supervisor)

Feed-up		
Waar werkt de student naartoe?	1. Dit is het beoogde leerresultaat/leerdoel:	a. Aan het eind van de les begrijpt de student de strategie bij het leiden van een voor de studenten bekend lied, b. … heeft de student de strategie ervaren
	2. Zo verheldert de docent leerdoelen:	De opleider geeft een voorbeeld, studenten observeren en daarna moeten ze benoemen
	3. Dit zijn de criteria voor succes:	a. Het is een succes als studenten de strategie (zie hieronder) herkennen en in woorden kunnen reproduceren: *Voorbereiding:* i. Begintoon opzoeken; ii. Toon overnemen voor jezelf; iii. Begintoon voorzingen; iv. Geven van een soort gebaar zodat de klas weet dat ze moeten zingen/meezingen; *De klas laten zingen (eventueel met tussenstap dat ze meezingen met de opleider):* v. Met de hele groep oogcontact maken; vi. Adem geven inclusief inzetgebaar (eventueel ook alleen adem geven); vii. Tijdens het zingen takteren in het tempo van het lied; viii. Tijdens het takteren observeren of: 1. Iedereen meezingt; 2. Tempo gelijk blijft; 3. Toonhoogte klopt met de melodie; 4. Juiste tekst wordt uitgesproken; ix. Afsluitgebaar; *Evaluatie:* x. De groep laten benoemen wat goed ging en wat beter kan
	4. Zo deelt de docent de criteria voor succes:	De opleider vraagt de studenten om haar lied-leiden te observeren en laat hen ontdekken wat de stappen van de strategie zijn. Vervolgens schrijft ze die stappen op het bord.
	5. Zo borgen we dat de student de leerdoelen en criteria begrijpt:	De opleider doet enkele keren foutief voor en checkt of de studenten doorhebben wat er niet goed gaat in de strategie van het leiden van een lied. Hiervoor zetten we de Technologie in. Studenten geven aan de hand van de Technologie antwoord op stellingen/observatiepunten om te checken in hoeverre de studenten het hebben begrepen. Studenten die het niet begrijpen krijgen extra uitleg over dat wat ze niet begrijpen.
	6. Daarin hebben de (mede)studenten de volgende rol:	Actieve deelname met de technologie op basis van gegeven stellingen/observatiepunten.

Feedback		
Waar staat de student nu?	7. Hierover wordt gediscussieerd:	De strategie (zie bij Feed-up)
	8. Zo realiseert de docent effectieve discussie:	Door vragen te stellen: In hoeverre heb je alle succes criteria voorbij zien komen? En wat gebeurt er als je één van die succescriteria mist. Zie verder het feedback model
	9. Dit bewijst dat er is geleerd (hoe ziet dat eruit?):	Studenten kennen de strategie
	10. Deze activiteiten realiseert de docent om het leren te bewijzen:	In tweetallen de succescriteria in de juiste volgorde vertellen (bord dicht)
	11. Zo activeren we studenten om als informatiebron voor elkaar te dienen:	Door het checken in tweetallen
	12. Dit willen we zien m.b.t. eigenaarschap:	Actieve houding bij de student
	13. Zo activeren we studenten in het stimuleren van eigenaarschap over het	Doordat studenten actief het gesprek in gaan (elkaar eventueel aanvullen)

Feed-foward		
Hoe komt de student bij de gewenste situatie?	14. Hier gaan we terugkoppeling over geven:	De strategie voor het leiden van een lied
	15. Dit zou het volgende leren moeten zijn:	Dat het lied leiden in het lijf gaat zitten
	16. Zo geeft de docent de terugkoppeling op verder leren:	Bord open en bespreken: Dit was de strategie. Benadrukken dat het zelf ervaren/doen de strategie nog beter laat beklijven. Vertellen: Daarom in groepjes zelfstandig oefenen. Doel is om je comfortabeler te voelen in het zelf leiden van een lied.
	17. Zo activeren we studenten om als informatiebron voor elkaar te dienen:	Vertellen dat de studenten elkaar kunnen helpen door elkaar tips te geven, te corrigeren, te complimenteren
	18. Dit willen we de volgende keer zien m.b.t. eigenaarschap:	Dat studenten actief met elkaar het lied leiden oefenen en elkaar daarbij ondersteunen, corrigeren, complimenteren, …
	19. Zo activeren we studenten in het stimuleren van eigenaarschap over het	Vertellen dat ze aan de slag mogen en eventueel aansporen om aan de slag te gaan.

Appendix R. Feedback analyzation form for activity 2 & 3 (Created by graduation supervisor)

Feed-up		
Waar werkt de student naartoe?	1. Dit is het beoogde leerresultaat/leerdoel:	a. Aan het eind van de les heeft de student het zelf leiden van een lied ervaren, b. … voelt de student zich comfortabeler in het leiden van een voor de student bekend lied c. … en kan de student de strategie voor het leiden van een lied (eventueel met hulp) zelfstandig doorlopen
	2. Zo verheldert de docent leerdoelen:	Zie ACTIVITEIT 1, Feed-Forward 16: Bord open. Bespreken: dit is de strategie. Benadrukken dat het zelf ervaren/doen de strategie nog beter laat beklijven. Daarom in groepjes zelfstandig oefenen.
	3. Dit zijn de criteria voor succes:	De student geeft aan zich comfortabeler te voelen bij het zelf leiden van een lied De student kan de strategie voor het leiden van een lied (eventueel met hulp) zelfstandig doorlopen
	4. Zo deelt de docent de criteria voor succes:	Vertellen van de doelen
	5. Zo borgen we dat de student de leerdoelen en criteria begrijpt:	Vragen aan de studenten wat de doelen zijn. Daarbij checken of iedereen het begrepen lijkt te hebben. De opleider benadrukt het belang van oefenen om zich comfortabel te voelen.
	6. Daarin hebben de (mede)studenten de volgende rol:	ACTIVITEIT 2: De studenten oefenen om de beurt met het leiden van een lied voor een klein groepje en vullen elkaar aan als er een stap van de strategie ontbreekt. ACTIVITEIT 3: Daarna enkele studenten voor de klas laten oefenen met de hele groep, waarbij eerst een deel van de groep en daarna de gehele groep aan de hand van de Technologie feedback geeft over het lied leiden door de studenten voor de groep

Feedback		
Waar staat de student nu?	7. Hierover wordt gediscussieerd:	Over: a. Wat de studenten hebben ervaren b. Het al dan niet comfortabel voelen bij het leren leiden van een lied c. De strategie voor het leiden van een lied
	8. Zo realiseert de docent effectieve discussie:	De opleider laat het Feedback-report zien en stelt vragen: a. Wat vond je makkelijk? Moeilijk? Wat laat het feedback-report daarover/nog meer zien? Wat moet/wil je nog meer oefenen? Wat vind je daarbij nog een uitdaging? b. In hoeverre zou je dit nu zelf in je stage kunnen? Wat moet je voor jezelf eventueel nog overwinnen? c. Welke stap(pen) in de strategie was/waren het makkelijkst om te onthouden? Welke stap(pen) vergeet je het snelst? Waarom is/zijn die stap(pen) toch belangrijk?
	9. Dit bewijst dat er is geleerd (hoe ziet dat eruit?):	a. De studenten geven aan dat ze zich comfortabeler voelen in het leiden van een lied; b. Op de vraag wie voor de klas wil oefenen zijn er meerdere studenten die zich daarvoor aanmelden; c. De studenten voor de groep passen de strategie op een juiste manier toe; d. De studenten in de groep geven correct feedback op de strategie en eventueel op relevant niet-muziek-didactisch gedrag van de studenten in de rol van de leerkracht.
	10. Deze activiteiten realiseeert de docent om het leren te bewijzen:	De opleider laat de studenten feedback geven met de Technologie. Daarmee verzamelt de opleider informatie over het leren doordat de door de studenten gegeven feedback wordt verzameld en kan worden ingezien, geanalyseeert en besproken. De opleider laat op het bord het Feedback-report zien en wijst op verbeter-trends in de grafieken
	11. Zo activeren we studenten om als informatiebron voor elkaar te dienen:	Voorafgaand aan ACTIVITEIT 2, zie ACTIVITEIT 1, Feed-Forward, 17: Vertellen dat de studenten elkaar kunnen helpen door elkaar tips te geven, te corrigeren, te complimenteren Tijdens ACTIVITEIT 2: De opleider loopt rond, checkt of studenten elkaar helpen en spoort hen daar eventueel toe aan Tijdens ACTIVITEIT 3: De opleider gebruikt de Technologie om studenten gericht feedback te laten geven op de studenten voor de klas
	12. Dit willen we zien m.b.t. eigenaarschap:	Tijdens ACTIVITEIT 2: De studenten helpen elkaar door elkaar tips te geven, te corrigeren, te complimenteren Tijdens ACTIVITEIT 3: De studenten zijn actief betrokken bij zowel het zingen als feedback geven via de Technologie en bij het reflecteren op het lied leiden van iedere student die voor de klas stond
	13. Zo activeren we studenten in het stimuleren van eigenaarschap over het eigen leren:	De opleider gebruikt de Technologie om de studenten die voor de klas stonden de gekregen feedback te laten samenvatten. De opleider gebruikt de Technologie om de studenten als "exit ticket" een vraag (of vragen) over het eigen leren te laten beantwoorden: Wat wil je van deze les onthouden m.b.t. de strategie?

Feed-foward		
Hoe komt de student bij de gewenste situatie?	14. Hier gaan we terugkoppeling over geven:	Het comfortabeler worden in het leiden van een lied door daarmee te oefenen met elkaar en in de stage. De strategie voor het leiden van een lied
	15. Dit zou het volgende leren moeten zijn:	Het zelfstandig (zonder hulp) kunnen leiden van een voor de student bekend lied. Het zelfstandig leventueel met hulp) kunnen leiden van een voor de student onbekend lied.
	16. Zo geeft de docent de terugkoppeling op verder leren:	De opleider maakt duidelijk wat het volgende leren moet zijn: De opleider nodigt de studenten uit om de komende tijd te oefenen in het zelfstandig leiden van een bekend lied en onbekend lied, met elkaar en in de stage.
	17. Zo activeren we studenten om als informatiebron voor elkaar te dienen:	De opleider geeft aan dat je ook buiten de les om met elkaar kunt oefenen, eventueel ook een video kunt opnemen van het lied leiden in de stage en die kunt bepspreken met medestudenten.
	18. Dit willen we de volgende keer zien m.b.t. eigenaarschap:	De studenten kunnen aangeven dat ze hebben geoefend en wat ze nog meer hebben gedaan om zich comfortabel te voelen bij het leiden van een lied.
	19. Zo activeren we studenten in het stimuleren van eigenaarschap over het eigen leren:	De opleider geeft aan dat in de volgende les het leren leiden van een canon centraal staat. Daarbij geeft de opleider aan dat het voor het leiden van een canon belangrijk is dat je de strategie voor het leiden van een lied comfortabel kunt uitvoeren.

Appendix S. Lesson design (Created by graduation supervisor)

Muziekles 5 en 6 maart 2024
Lestijd: 75 minuten
Zuivere lestijd: 65 minuten

Doelen:
1. Aan het eind van de les begrijpt de student de strategie bij het leiden van een voor de studenten bekend lied,
2. … en voelt de student zich comfortabeler in het leiden van het lied.

Introductie op de les (5 minuten):
1. De opleider heet de studenten welkom
2. De opleider introduceert het de onderzoeker die het onderzoek introduceert + consent formulieren laat ondertekenen.

Activiteit 1 – Aanleren van de strategie voor het leiden van een lied (opleider doet voor):
Feed-up:
1. De opleider vraagt de studenten om haar lied-leiden te observeren en laat hen ontdekken wat de stappen van de strategie zijn.
2. De opleider schrijft die stappen vervolgens op het bord.
3. De opleider doet enkele keren foutief voor en checkt of de studenten doorhebben wat er niet goed gaat in de strategie van het leiden van een lied. Hiervoor zetten we de Technologie in. Studenten geven daarbij aan de hand van de Technologie antwoord op stellingen/observatiepunten om te checken in hoeverre de studenten het hebben begrepen. Studenten die het niet begrijpen krijgen extra uitleg over dat wat ze niet begrijpen.
Feedback:
4. De opleider stelt plenair vragen: In hoeverre heb je alle succes criteria voorbij zien komen? Daarbij eventueel het feedback-report tonen en bespreken wat opvalt. Wat gebeurt er als je één van die succescriteria mist. Zie verder het feedback model.
5. De studenten vertellen elkaar de stappen in de strategie (in tweetallen, bord dicht)
Feed-forward:
In dit geval overlapt de feed-forward van deze activiteit met de Feed-up van Activiteit 2

Activiteit 2 – Studenten oefenen zelfstandig in kleine groepjes:
Feed-up:
6. Bord open. De opleider:
   a. Bespreekt de strategie nogmaals en legt uit dat het zelf ervaren/doen de strategie nog beter laat beklijven en dat dat de reden is dat de studenten in groepjes zelfstandig gaan oefenen;
   b. Benadrukt daarbij het doel:
      i. Je comfortabeler voelen in het zelf leiden van een lied;
      ii. De strategie voor het leiden van een lied (eventueel met hulp) zelfstandig kunnen doorlopen;
   c. Benadrukt daarbij dat de studenten elkaar kunnen helpen door elkaar tips te geven, te corrigeren, te complimenteren;

d. Vraagt aan de studenten wat de doelen zijn en checkt of iedereen het begrepen lijkt te hebben
e. Geeft aan dat de studenten aan de slag mogen (eventueel aansporen).

Feedback:

7. De opleider vraagt de studenten wat ze hebben ervaren: Wat vond je makkelijk? Moeilijk?

Feed-forward:

8. De opleider benadrukt het belang van oefenen om zich comfortabel te voelen in het leren leiden van een lied en het onthouden van de strategie.

Activiteit 3 – Enkele studenten oefenen voor de hele klas:

Feed-up:

9. De opleider geeft aan dat we de Technologie weer gaan gebruiken
10. De opleider vraagt een vrijwilliger die voor de klas met de hele groep wil oefenen en 3-5 vrijwilligers die met de technologie feedback willen aan de student die voor de groep staat.
11. Na elke oefenronde laat de opleider de student voor de klas een samenvatting schrijven en vraagt de opleider aan de andere studenten om aan te geven in hoeverre stappen in de strategie gemist zijn.

Feedback:

12. De opleider vraagt aan de student voor de klas wat die heeft ervaren: Wat vond je makkelijk? Moeilijk? Wat heb je ervaren met betrekking tot de Technologie?
13. De opleider herhaalt stappen 10, 11 en 12 met een andere vrijwilliger.
14. De opleider geeft aan dat nu iedereen met de Technologie feedback gaat geven de observerende studenten om feedback
15. De opleider herhaalt stappen 10, 11 en 12 met een andere vrijwilliger en laat eventueel op het bord het Feedback-report zien en wijst op verbeter-trends in de grafieken, met name gericht op de studenten die feedback geven: Heeft iedereen dezelfde dingen gezien?

Feed-up:

16. De opleider gebruikt de Technologie om de studenten als “exit ticket” een vraag (of vragen) over het eigen leren te laten beantwoorden: Wat wil je van deze les onthouden m.b.t. de strategie om je comfortabeler te voelen in het leiden van een lied?
17. De opleider legt uit dat het volgende leren moet zijn:
    a. Het zelfstandig (zonder hulp) kunnen leiden van een voor de student bekend lied.
    b. Het zelfstandig eventueel met hulp) kunnen leiden van een voor de student onbekend lied.
18. De opleider legt uit dat de studenten in de volgende les moeten kunnen aangeven dat ze hebben geoefend en wat ze nog meer hebben gedaan om zich comfortabel te voelen bij het leiden van een lied.
19. De opleider geeft aan dat in de volgende les verder het leren leiden van een canon centraal staat. Daarbij geeft de opleider aan dat het voor het leiden van een canon belangrijk is dat je de strategie voor het leiden van een lied comfortabel kunt uitvoeren.
20. De opleider nodigt de studenten uit om de komende tijd te oefenen in het zelfstandig leiden van een bekend lied en onbekend lied, met elkaar en in de stage. De opleider geeft aan dat je ook buiten de les om met elkaar kunt oefenen, eventueel ook een video kunt opnemen van het lied leiden in de stage en die kunt bespreken met medestudenten.

Afsluiting van de les – Evaluatie van de tool (10 minuten)

21. De opleider vraagt aan de studenten om een korte online vragenlijst (3-5 vragen) in te vullen als evaluatie op de implementatie van de Technologie
22. De opleider geeft studenten de gelegenheid om ook mondeling te reageren op de implementatie van de technologie.
23. De opleider sluit de les af.

Appendix T. Summarized KPZ survey results

These results are summarized and grouped categorically in order to give an impression of the results of the survey. This means that the answers in the open questions tables are not littery the answers that were given, but the answers which agreed with each other. This was done, because there was no other way to properly display results of 76 interviews in this appendix besides using a page for each survey. This means that some sentiment of the participants is lost, and the class that the answers were given in is lost. It is also not possible to connect the given answers in different questions to each other. This is however only the case for the reader, since the research was done with the full survey results.

Hoe sta jij tegenover het gebruik van apps en websites voor het leren in de opleiding? 1= Heel negatief, 5= Heel positief	**Count (out of 76)**
1	1 = 1%
2	6 = 8%
3	38 = 50%
4	30 = 39%
5	1 = 1%

3a. Op welke manier heeft de technologie bijgedragen aan wat jij deze les hebt geleerd?	**Count (out of 76)**
Reflecting on what is happening	14 = 18%
Other (irrelevant, unclear)	13 = 17%
Providing feedback	11 = 14%
Nothing / not a lot	10 = 13%
I was more involved in the class	6 = 8%
Receiving feedback	6 = 8%
Could’ve been done in a different way (like verbal)	5 = 7%
Criteria for providing feedback	5 = 7%
Providing live feedback	3 = 4%
It was a distraction	1 = 1%
Technology interrupted the session	1 = 1%
Was too time consuming	1 = 1%

3b. Hoe makkelijk heb jij kunnen werken met de technologie? 1 = Helemaal niet makkelijk, 5= Heel makkelijk	**Count (out of 76)**
1	1 = 1%
2	16 = 21%
3	20 = 26%
4	28 = 37%
5	11 = 14%

3c. Hoe tevreden ben jij met hoe de technologie is toegepast in de les? 1= Helemaal niet tevreden, 5= Heel tevreden	Count (out of 76)
1	2 = 3%
2	17 = 22%
3	34 = 45%
4	19 = 25%
5	4 = 5%

3c. Hoe tevreden ben jij met hoe de technologie is toegepast in de les? 1= Helemaal niet tevreden, 5= Heel tevreden	Count (out of 45)
It was too time consuming because of long loading times	17 = 22%
It did not add at a lot to the class	11 = 14%
It was a nice addition	10 = 13%
I was easily distracted because of my phone	9 = 12%
Neutral	6 = 8%
The technology was a disruption	6 = 8%
It worked nicely	4 = 5%
Other (irrelevant, unclear)	4 = 5%
The use of technology was redundant	3 = 4%
It was a good way to give feedback	3 = 4%
It increased involvement	2 = 3%
It could've been used more	1 = 1%

4b. Wat kan/moet volgens jou eventueel anders om het geven, ontvangen en leren van feedback te optimaliseren?	Count (out of 44)
Other (irrelevant / unclear)	19 = 43%
Verbal feedback	5 = 11%
The site worked pleasantly	5 = 11%
Faster website	3 = 7%
Analog written feedback	2 = 5%
Discuss all the feedback	2 = 5%
A lot of practice in the classes	2 = 5%
Give everybody the chance	1 = 2%
No use of technology	1 = 2%
Share the feedback with the entire class	1 = 2%
Less frequent, but more elaborate feedback moments	1 = 2%
Feedback via open questions	1 = 2%
Receiving feedback during teaching is unhandy	1 = 2%

4b. Wat kan/moet volgens jou eventueel anders, zodat de technologie beter wordt benut?	Count (out of 49)
Other (irrelevant / unclear)	17 = 35%
Faster application	11 = 22%

4b. Wat kan/moet volgens jou eventueel anders, zodat de technologie beter wordt benut?	Count (out of 49)
Technology is not required everywhere	3 = 6%
Use in other subjects	3 = 6%
Use on a different device than your own phone	2 = 4%
More practice	2 = 4%
Remove bug	1 = 2%
More feedback questions	1 = 2%
Utilize more than just feedback	1 = 2%
After the class session instead of during	1 = 2%
Increase font size	1 = 2%
It should be more challenging	1 = 2%
The educator should be more experienced with the technology	1 = 2%
Whispers longer on the screen	1 = 2%
Add ways of giving feedback that can not be added on paper	1 = 2%
Lock the devices so that they can only be used to provide feedback	1 = 2%
Clearer explanation about the technology beforehand	1 = 2%

4b. Wat kan/moet volgens jou eventueel anders, zodat je beter wordt ondersteund door de technologie en zodat je daarmee beter leert?	Count (out of 33)
Other (irrelevant / unclear)	21 = 64%
Should not use technology	3 = 9%
Decrease load times	1 = 3%
Different kind of site	1 = 3%
Everybody on a laptop	1 = 3%
Less distractions	1 = 3%
Explain more about the website beforehand	1 = 3%
Do not use unnecessary feedback criteria	1 = 3%
Make the answers of others visible	1 = 3%
Receive feedback more clearly	1 = 3%
Increase font sizes	1 = 3%

5. Welke tips heb je nog voor de ontwikkelaars van de technologie en voor de ontwerpers van de les?	Count (out of 36)
Other (irrelevant / unclear)	16 = 44%
Improve visual design	8 = 22%
Make it go faster	5 = 14%
Technology is not necessary	2 = 6%
You do not have to improve something that already works	1 = 3%
Use it for after the class session	1 = 3%
Create clearer criteria	1 = 3%
Develop an app instead of a website	1 = 3%
Not on the phone	1 = 3%

Appendix U. Guidelines and considerations of using the feedback tool in a class setting

- The tool should not interrupt the class
  - The tool should work fast, Students preserve the tool as ineffective when they need to wait for it to load.
  - Students should log in to the tool at the start of the session.
  - Switching between giving feedback and not giving feedback should be infrequent.
- Students should not be distracted by the technology
  - What worked during the lesson study is that the educator told the students to put their phones into do not disturb mode
  - Students got distracted by notifications. The system is not tested in a class on a laptop, but this might be beneficial
  - Students should put their phones away when they do not use them
- In some sessions, some students were tasked with giving feedback whilst the other students followed the lesson as normal.
  - This was proven to work great for shorter sessions
- Students are vulnerable when they are in front of the class.
  - Having someone give feedback during this session might make a student doubt themselves.
  - Having a phone available during these sessions might potentially lead to inappropriate use, like recording of the presenting student.
  - Student safety should be considered thoroughly
- When in front of the class, a mobile screen is too small to read incoming feedback
  - The student in front of the class should have a tablet available to receive whispers
- Not everyone likes technology in the classroom.
  - This might be more prevalent in practical classes like music.

Appendix V. Survey questions Experiment LUCA

The number in the first column on the left is the number of the research question that the survey question aims to answer.

	Also on control group survey	Question	Type
		Wat was jouw inlognaam op de website? (eg. LUCA-5)	Open
3		Was de website het juiste middel om feedback te geven in deze setting?	Ja/nee
3		Bij nee: Welk middel was gepaster geweest om feedback te geven in deze setting?	Open
3		Bij nee: Kan je je een andere context voorstellen waarin de technologie meer gepast is?	Open
2		Wat deed het geven van feedback met jouw betrokkenheid bij de microteaching sessie?	Likert (5 point) Het maakte dat ik veel minder betrokken was Het maakte dat ik minder betrokken was Neutraal Het maakte dat ik Meer betrokken was Het maakte dat ik veel meer betrokken was
2		Waardoor was jij meer of minder betrokken?	Open
1		Hoe storend vond je de technologie in de klas?	Likert Erg storend Storend Neutraal Minimaal storend Totaal niet storend
1		Indien van toepassing, wat vind je storend aan de technologie?	Open
6	X	Hoeveel heb jij geleerd van het geven van feedback?	Likert (5 point) Heel weinig Weinig Neutraal Veel Erg veel

	Also on control group survey	Question	Type
6	X	Hoeveel heb jij geleerd van de ontvangen feedback?	Likert (5 point) Heel weinig Weinig Neutraal Veel Erg veel
4		Op welke manier heeft het ontvangen van feedback bijgedragen tijdens het geven van de micro-teaching?	Open
4		Op welke manier heeft het geven van feedback bijgedragen tijdens het volgen van de micro-teaching?	Open
6	X	Welk onderdeel van het feedbackproces was voor jou het meest waardevol en waarom?	Open
5	X	Waar ben jij tegenaan gelopen tijdens het feedback proces?	Open
		Wat zou jij graag anders willen zien?	Open

Appendix W. Observation criteria LUCA

Observation procedure
There will be one neutral observer present during the experiment. The neutral observer will observe based on the same criteria as the researcher. This will ensure a high sample of observations on a narrow spectrum of specific events during the sessions. The observers will pay attention to the following criteria.

- **How do the students communicate with each other?** -> This means all forms of communication, and can be that they give (non) verbal feedback, but also if they show antisocial behavior.
- **What do the students use their phone for?** -> Is it only being used for giving feedback, or are they using it for other things as well?
- **In what ways are the distractions caused by the technology visible?** -> Does it interrupt the class when people reach for their phones? Is it distracting for the presenting student to receive whispers? Are there other noteworthy distractions?

If something noteworthy occurs, it will also be noted even if it does not fit one of the criteria.

Appendix X. Feedback criteria in class experiment 2

Stage	Class	Criteria	Type	Tags / MC options
1	1	De instructies zijn heel duidelijk	Likert	-
1	2	Het is helemaal duidelijk wat ik moet doen	Likert	-
1	1/2	De student geeft waar mogelijk non-verbale instructies	Rubric	“Denk ook aan non-verbale instructies”. “ Non-verbaal goed bezig”, “Geef duidelijkere non-verbale instructies”
1	1/2	Ik voel mij helemaal muzikaal geactiveerd bij dit lied	Likert	-
1	1/2	Ik voel mijzelf betrokken bij deze activiteit	Rubric	“Ik zou meer willen doen”, “De uitleg mag korter/minder”, “ Fijn dat ik actief bezig ben”, “Is iedereen actief bezig op dit moment?”
2	1	Hoe was de activiteit opgebouwd?	Open	-
2	2	Wat vind je van de opbouw van die activiteit?	Open	-
2	1/2	Welke manieren van communicatie gebruikte de student?	Multiple choice	“Verbale instructie”, “Met voeten”, “Met gezicht”, “Met been”, “Met bovenlijf”, “Met handen”, “Met hoofd”
3	1/2	Welke tips neem je mee voor jezelf?	Open	-
3	1/2	Het is voor mij duidelijk wat ik wil herwerken voor de workshop van volgende week	Likert	-
3	1/2	Ik ga mijn workshop zo aanpassen:	Open	-

Appendix Y. Observations researcher during LUCA Leuven experiment

Session 1 (Day 1)

De feedbackcriteria zijn niet besproken voor de eerste sessie, dit kan impact hebben op de hoeveelheid feedback die wordt gegeven aangezien studenten niet weten waarop ze feedback moeten geven.

How do the students communicate with each other?

The session starts interactive. The presenter asks, how do you feel today? And “Do you know what a life motto is?” People hesitate to answer. People answer verbally and non verbally.

The educator interrupted class to give a suggestion. This suggestion was a complete alteration of the session (She suggested trying the exercise with music). She did this verbally, and the interaction back from the student was also verbally. This means that for big interruptions class interruptions are still required.

After 12 minutes, only 2 pieces of feedback were given. One phone is still on a chair behind a student.

Another whisper was sent to the presenting student at a later time. I’m doubtful if she saw the whisper and read it, since it was a long one. The whispers have an encouraging nature so far.

She pointed something out in front of the class, one of the students pointed out to her verbally that the person she is pointing it out for does not see her. This is feedback that she should see immediately.

Something in the session is too fast, they tell the person in front of the class this verbally.

At the end of the session the people had to give feedback.

The feedback timeline does not load on one of the phones (google pixel with google chrome). It was a visual bug.

What do the students use their phone for?

Students have not touched their phone in the first 5 minutes. I noticed a girl reaching for her phone but not taking it. This might indicate that she wants to give feedback but was not able to. 1 minute later she gave feedback. This was not interrupting the class since they had a second to do the action during the session. Someone picks up their phone and puts it away right away.

So far the phone was not distracting them

In what ways are the distractions caused by the technology visible?

One person keeps her phone on her leg during the start. The other students have them in their pockets. Whilst the students stand up, the phone is left on the chair, leaving for no possibility to give feedback.

When loes send out the whisper “Goed dat je feedback vraagt aan de groep!”, it was not a distraction at all. I have not seen if the presenting student saw the whisper in front of the class.

The summarizing of the feedback takes longer than it should.

Someone was texting in between sessions

Other

Session 2 (Day 1)

How do the students communicate with each other?

Again, the session starts interactive with questions. The answers are given verbally and non-verbally with head shakes on a no. The students are fooling around a bit, They are playing a bit that they are children. This is because they are simulating a session in a primary school.

A whisper was given that the other person should lead as well. She made eye contact with the educator, the educator gave a thumbs up and she continued. The feedback was that she took the lead too much. The feedback was effective, and the other person started taking the lead because she was given the space to.

Another whisper was sent, instructing her to talk clearer. This time she saw the whisper. She talks more clearly afterwards.

What do the students use their phone for?

The students have not used their phone after the first ten minutes. The setting might impact this. This also means that they have not given any feedback as of yet.

In what ways are the distractions caused by the technology visible?

She read a whisper, and stopped for one or two seconds to look at the laptop.

Other

Another whisper is sent by the educator, it was not seen by the presenting student. The educator does not send the whisper again. The whispers are overall complements. Another whisper is sent to instruct her to speak slower. She immediately starts speaking slower afterwards. The educator is using whispers frequently to give compliments or instructions. She did not use the tags as of yet.

During the micro teaching sessions, there really is not a lot of time to give feedback. Students do not use it, because they might find it too disrupting.

There was no feedback at all given during the workshop. This might be because all the students were too activated.

Giving the feedback after the session is taking a while. This might also be because the feedback is not given during the session.

A good functionality for you might be that you can set a timer for x minutes to end the session

Session 3 (Day 1)

From this session on, we have 10 students in the class following the micro teaching instead of 4. A lot of feedback had been given during this session.

How do the students communicate with each other?

Interactie begint wederom met vragen om de sessie in te luiden. Deze worden veelal verbaal beantwoord.

What do the students use their phone for?

-

In what ways are the distractions caused by the technology visible?

In the beginning of the session, people sit down. Students tend to put their phones on their leg. This time everybody picked up their phone. Some students still have their phone in their hand during the first phase of standing up. After about 1 minute, they put the phone down and put it on the chair behind them. After the first activity, this person picks up the phone and gives feedback.

Other

A whisper was sent, but both the educators are standing in front of the laptop which means that they will not be able to see this.
The session is yet again really interactive, meaning that there is not really a lot of time for the students to give feedback. Yet 4 out of 10 students have already given feedback.

The students are standing in a circle. Also the teaching students. This means that they can not see the laptop where the whispers are given. After the session they say that they did this because they did not want to act like an authority figure and they wanted to be in the classroom.

There is a moment where students have to sit down when they have lost a game, this moment is not used by a lot of students to give feedback. Some students do however use this moment.

One student is at the end not done giving feedback yet, she apologies to the class and feels visibly pressured.

Summarizing the feedback on the laptop might take a bit longer than previously because the Belgium people use an AZERTY keyboard instead of a QWERTY one which the researchers provided them with.

Session 4 (Day 1)

This session was again in the class. This might be because of the nature of teaching in a simulation setting. This was resolved by placing the laptop in front of the class, since the educator told the student beforehand that the laptop could include feedback for her.

How do the students communicate with each other?

The students are really involved in the session and are following the presenter.

What do the students use their phone for?

The students did not use their phones as of yet as they are busy doing activities which does not leave

any room for the tool to be used.

In what ways are the distractions caused by the technology visible?

The laptop was on the ground, because the student was sitting in the center of the class with the other students. At a later moment, the students had to walk around the class to reenact something. This caused a student to think that the laptop was endangered, putting it on the table. After this, the laptop was not visible anymore for the presenting student.

Other

Before the session, there was one person with a visual bug on the screen. Waiting for a couple of seconds, the bug was resolved. Another person tough that a new session had not been started, but it had. Indicating that this might need some more assistance via the UI. This is another really interactive session, it does not seem like the students do have any time to give feedback.

The educator has only used custom whispers so far. She has not used the tag functionality, or the forwarding of feedback. This might be because not a lot of verbal feedback has been given.

The students do not reach at all for their phones during this activity, and no feedback has been given so far. And the student does have the time to reach for her water bottle however.

At the end, the presenting student had to do something on the computer. This was a moment for some students to give feedback.

One plus nord 2 -> Also got a bug that receiving feedback was not possible anymore. This student continues afterwards on their Ipad

After all the sessions (day 1)

During all the sessions of the first day, no feedback was given that people did not find it clear if their feedback was sent. This might indicate that this problem is solved with the new indicators.

After the session, there were 3 more questions to reflect on for the students. The educator found one of them noteworthy, and wanted to elaborate on this. She thought that she knew who the student was who wrote it, but it turned out that another student wrote it.

Session 5 (Day 2)

During this day 2 students join the class at a later moment, they are left out of the research

How do the students communicate with each other?

The students get verbal instructions and follow them, he asks questions, and the people follow up by executing the instructions. Later on they are asked questions by the presenting student, and they answer verbally and voluntarily by the class. The students also communicate during the session with each other verbally. This was at a moment when not a lot was happening and the presenting students were preparing something. The students in the class attended each other by mistake.

After the session, the students have to summarize their feedback. Someone filled in totally disagree

with the question: “Ik voel mij helemaal muzikaal geactiveerd bij dit lied”. They asked in the class why this was, and they resolved this problem. Someone accidentally selected the wrong option.

What do the students use their phone for?
During this session, they only used it for giving feedback as far as the researcher has seen.

In what ways are the distractions caused by the technology visible?
Students leave their phones in the classroom. Sometimes they look at their phones but it does not really look like a distraction. They use the phones with strategic timing to not cause too much of a distraction. They are statically listening to a song, the students yet again choose this moment to give feedback which is fitting.

Other
In the beginning of the session, the students were instructed to get in front of the class. Two students left their phones on the table, leaving them unable to give feedback. A little bit later, they are moved to the piano on the other side of the classroom, and one student takes this moment to pick up her phone. She uses it immediately to give feedback. Some other students also use this moment to give feedback. The whispers send during this session were all off complimentative nature,

The students tend to leave their phones a lot on the table. Some students even have their phones set to always leave their screen on, letting them give feedback quicker.

There was a visual bug with the timeline on the Samsung browser. All the visual bugs so far have been with the timeline, especially when they start horizontally scrolling. The bug also continues for him on another phone.

The students did not see clearly enough that they had to summarize the feedback. They did not summarize it and just looked at the feedback instead. They requested to get the feedback send afterwards to which the researcher agreed.

Session 6 (Day 2)

How do the students communicate with each other?
The students need to speed date during a song. When the song starts they start conversing. However they do not give feedback to each other. This speed dating is done based on questions. That they have to answer to each other. They however do deviate from the question a lot which might be by design.

What do the students use their phone for?
During the beginning, the students do not use their phone at all. They are talking to each other as this is the exercise. There is not a lot of interference from the presenting students so there is also not a lot of need to give feedback.

In what ways are the distractions caused by the technology visible?
One student says during the speed dating session that he wants to give feedback, takes out their phone and wants to type something. He can not type yet, since there are only rubrics of one and likert questions. He walks to the researcher to ask how he can write feedback. The researcher tells him that he has to select yes/no first. The person gives his feedback, and starts typing in the middle of the

class for a couple of seconds. This same person comes later to the researcher and asks how he can give more feedback to the same question. It was answered by the researcher that he can type more after the already given feedback.

The guitar is out of tune, the presenter has to tune it. Students take this moment as an opportunity to give feedback.

During the end of the session, there was not a lot of feedback given. The session was very interactive and the students were busy at all times with the session. This might also be because they forgot about the tool, or do not have a lot of feedback to give.

One student is afraid that the feedback is too much of a distraction during the sessions.

Idea of one of one of the students is a small lamp in the back of the class, so that it can light up when a whisper is visible. Then the person in front of the class can decide if they want to visit the laptop to look at it or not.

Other

The educator asks the researcher if the icons which she can use to react to the feedback are for her. The researcher answers with yes, she leaves an icon on a comment that was typed.

The presenting student was instructed before the class that she would get feedback on the laptop. The laptop was on a table. She says that she has an interactive session which moves throughout the class. She is instructed by the educator that she can move it into sight if she wants to. She does not move it. She is in front of the laptop for the entire session, not leaving a possibility for her to look at the whispers.

The students ask again if they can ask questions about the given feedback when summarizing. This is again about the negative feedback. It leads to a discussion where one person gives feedback about how to implement it better. The presenters agree with these. Even though the feedback was negative in the first instance, they manage to get a positive take away from it.

After the session, one student is giving a lot of verbal feedback. The tool is not used for this. The feedback is more directed towards specific cases in the session. This might be caused by the criteria being global and this feedback not fitting the criteria.

Another question is asked about the automatic saving/storing of the feedback. This might mean that it should be indicated more clearly.

Appendix Z. Observations neutral observer during LUCA Leuven experiment

Session 1 (Day 1)

How do the students communicate with each other?

The session starts in an interactive manner. The pupils in front of the class ask questions to their peers to introduce their theme. The peers struggle to answer their question. After the introduction the peers seem more comfortable with the lecture. The pupils check in from time to time with their peers, to see if they understand and follow their lecture still. The pupils answer non-verbally by putting their heads up and down, and saying verbally 'yes'.

One of the pupils made a remark about something the instructing student said. He seemingly finds something she said funny. She was trying to show something, and said 'here', while pointing at a different slide. The pupil found it funny that the other student could not see where she was pointing at, so he was laughing out loud and commenting about it.

After the session the students are filling in the feedback form.

What do the students use their phone for?

During the session the pupils that follow the instructions don't use their phone at all. They are paying undivided attention to their peers. Some students have their mobile phone in the back pockets of their jeans/trousers, and one phone is laying still on a chair behind a pupil.

The students seem to at first only use their phone for the feedback. After they're finished with filling in the feedback one of the pupils seems to be typing on her phone, or searching something.
There was one student who could not use her phone

In what ways are the distractions caused by the technology visible?

During the session there is no visible distraction caused by the technology.

Other

One student is experiencing some trouble filling in the feedback, her phone doesn't seem to work. The student needed some help from Midas, to fix the problem. Although the problem could not be fixed. The student suggested to use her other phone. The teacher agreed but after she's given her own session.

Session 2 (Day 1)

How do the students communicate with each other?

During the session the pupils that give the session try to get their peers attention by asking questions, the answers are given verbally after pointing a finger to show the instructors they have an idea about the answer.

During the session there was one pupil who needed to leave the classroom for a brief moment, she whispered something to the teacher that seemed like a question. After a brief moment she came back in the classroom. The session is not disrupted by it though.

What do the students use their phone for?
Before the start of the session the pupils test out the tool, the teacher asks the pupils if they could already answer some of the questions the tool is asking. The peers do what they are asked to, and fill in a part of the feedback on their phone.

After the session the students turn to their phone to give feedback by using the tool.

In what ways are the distractions caused by the technology visible?
During the session there seem to be no distractions caused by their mobile phones.

Other
During the session one student interrupted the session - quietly- by moving his way through the classroom and making non-verbal waves, whispering quietly verbally ‘sorry’. Leaving briefly after he had what he seemingly needed. The students didn’t seem to be bothered by this distraction.

Session 3 (Day 1)

How do the students communicate with each other?
The students communicate verbally and non-verbally with each other. During the session there are different exercises where there is a competing element. The students are very fanatic. Some students make verbal comments about the difficulty of the exercise. There is a variety of verbal and non-verbal ways of communicating.

After the session the students fill in the feedback form by answering the questions. After finishing this, some students are chatting with each other. Other students are waiting in silence, or drink some water.

What do the students use their phone for?
Before the session starts, the students seem to only use their phone phone for filling in the feedback. Some students have their phone in their hand when they sit, others put their phone on their leg. When the students have to stand up, some put their phone in the back pockets of their phone. Others lay it on the chair behind them, as they need both hands for the session.
During a change of exercise, 2 students grab their phone and they seem to be answering a question on the tool.

In what ways are the distractions caused by the technology visible?
During a change of exercise, 2 students grab their phone and they seem to be answering a question on the tool. So they seem to only use it for the tool.

Other
-

Session 4 (Day 1)

How do the students communicate with each other?
Some students chat with each other, others are quiet. When the session starts, the students become silent and their attention turns towards the instructing student. During the session all the students are engaged with the exercise. Some look tired, they show that by yawning, they also look less energetic compared to the previous sessions. Still they are engaged with the exercise, even though they are tired.

There are two boys who make a playful connection with each other during the exercise.

When the students fill in their feedback, some become quiet. Except for one girl, she's chatting with the instructing peer about some feedback. She seems to be giving her tips and tricks, verbally.

What do the students use their phone for?
Before the session some students use it for installing the tool, others use it for texting or social media. As soon as the session starts, everyone puts their phone away. Because they need both hands for the exercise.

After the session the students turn to their phone to give their peer feedback. One girl is chatting with the instructing peer, she seems to give her feedback verbally. After this she turns to her phone to answer the questions on the form.

In what ways are the distractions caused by the technology visible?
Some pupils use their phone before the session starts, they seem to be texting. As soon as the session starts, the students put their phone away. No one seems to be distracted by their phone.

Other
After the teacher gave some verbal instructions, one student had a questioning look on her face. She raised her eyebrows and widened her eyes, turning her face towards the teacher.

Session 5 (Day 2)

How do the students communicate with each other?
As the session starts the instructors ask the students to get up, and get in front of the class to form a circle. All the students follow the instructors instructions. One of the students has her phone in her hands, but as soon as the students have to use both hands, she puts her phone away (first on the table, then in the back pocket of her jeans).
While the students are busy with the session, another student knocks on the door. The students say: 'Binnen'. And she opens the door. There is a discussion about the students, as they had an appointment with the teacher to join the session. When the students join the group, the instructors proceed with their session. During the session the students communicate verbally, they chat about the lyrics of the song that's playing in the background.
While the students fill in the feedback on their phone, some students stumble upon some questions. They turn towards Midas to get some help from him.

What do the students use their phone for?
The students use their phone to install the tool.
When there is a change of exercise, one girl gets her phone out of her back pocket and she seems to give some feedback. She doesn't get much time to do so, she suddenly puts her phone away. They

seem to only use their phone for giving feedback.
After the session the students fill in the feedback on their phone.

In what ways are the distractions caused by the technology visible?
There don't seem to be any distractions caused by their mobile phones.

Other
Before the start of the first session, Midas asks the students to put their phone to 'do not interrupt'. Because notifications may be distracting them from paying attention to the session. There was one girl who could not scan the QR code with her phone, but Midas helped her to get to the website in a different way.

Session 6 (Day 2)

How do the students communicate with each other?
As soon as the session starts, the students follow the instructors instructions. The form of the exercise is a speeddate, where all the students are sitting in front of each other. The instructing student is asking a question, that question is the subject where the students will be talking about. While the students chat, there is a song by Adele playing: 'Fire to the rain'. When the song stops, they switch partners and when the song starts playing again, they start chatting again.

Between the exercises the instructor walks out of the room, as part of the exercise.At that moment, two students who are still in the room are discussing with each other. I can hear it's about the exercise.

What do the students use their phone for?
At the beginning of the session, the students don't use their phone at all.
During the exercise, when they have the time, there are two students who use their phone to use the feedback tool.

In what ways are the distractions caused by the technology visible?
The distractions are caused by the one using the technology, there was one student who had a few questions about the tool. He came running towards Midas to get some help with it. After the questions were answered, the student went back to his place to continue with the session.

Other
After the session there are a few students that give suggestions about the feedback tool. There is one in particular, one student is suggesting when there is feedback given and sent to the laptop, there could be a light signal at the back of the classroom. Which suggests the instructing student to go and see the feedback at the laptop.

Appendix AA. Interview educator LUCA 1

R1 = researcher 1, R2 = neutral observer 2, E = educator

R1: How did you experience the sessions of today and yesterday?
E: It was a bit more complex than usual, I had a lot to think about like when to start the tool. I think this impact will be minimalized when you use the system more often. So in the long term I think that the extra burden is not very different from the default situation.
R1: Did you feel like you couldn't perform certain tasks as well as usual because of this?
E: I made a consideration, what feedback do I give via the tool, and what do I put in a document to give afterwards to the students. Sometimes it is important for students to know something which is not relevant at that moment. That was mostly during the sessions of the first day. The second day it already became more clear.
R1: Yes, today I noticed that presenting students did not often not have the laptop in their vision during the second day, did this have an impact on your previous answer?
E: Yes maybe, but during the group of the first day which implemented the whispers it was really nicely clear for me which feedback to send, and which feedback to keep for a while.
R1: Did you notice any difference in how active the students were during the session compared to sessions of the previous years?
E: No, I do not think so. I also do not think that the followers are distracted by the technology. The tool has been used more on the second day than on the first day, and there I do not notice any difference. Second year students often give more relevant feedback than first year students. I think activating to give feedback in the first year weighs more than in the second year.
R1: Did you find the technology to be a disruption in the classroom?
E: No, because the moments that the students have an active activity, they ignore the technology. The fact that the tool can be ignored makes it not a disruption.
R1: Which problems did you see students encounter when using the tool?
E: Some technical problems, you see that the students quit the activity and ask it to you [the researcher]. So when something fails technically, it pulls them away.
R1: Do you think that this would also be the case when I'm not present in the classroom?
E: Then they would come to me. They would interrupt the activity when something goes wrong with the technology, but that is a constant in education. When you work with something, and it does not do what it is supposed to, you quit what you are doing and all attention goes to fixing the technical problem. Also, the summary after the feedback did really slow down the process. That is a moment that a part of the class is doing something and other students are not. I would like to see this done quicker. I was asking myself what additional value the summary has, because I think that the summary is always made automatically in the heads of the students.
R1: Yes, we are afraid that when we only do the class session without a summary that students do not have another good look at the feedback that has been given.
E: I would ask the students to do this as homework. And let them send it to me, and not here in the classroom. The students are the requesting party in this scenario, since they have to give a workshop next week so they want to receive feedback. That is why it was unnecessary here, but indeed I do not know if this is also the case for other micro teaching settings. A drawback of doing it at home however is that you can not discuss it in the classroom anymore. But then I think that it would still be more interesting in the classroom to have a conversation instead of creating a summary. Then you can ask the presenting students which feedback they do see, and what they want to talk about, and ask the

other students if they have any other notes.
R1: Yes, so like today already happened a bit when the students started discussing the feedback verbally.
E: Yes, yesterday I didn't really do this because there was not a lot of time available, and I missed that. The real conversation after. I think that the tool is really nice for feeding this conversation, because otherwise some feedback will be forgotten during the session, but I think that the conversation is still necessary.
R1: What do you think of the quality of the feedback that has been provided?
E: With the second year students better than with the first year students. But that is also the case in other micro teachings where the technology is not being used. They look more thoroughly, more with a musical pedagogical eye at the activity. Students in the first year often do not come a lot further than saying "I was very involved", but they do not say why. The tool can help to get deeper into this with these students, but then you would need a bit more time than what we had on the first day.
R1: Do you think that the same difference in quality of feedback would have been visible when the tool had not been used?
E: Yes, that is always there, that is not connected to the tool. I think yesterday more default feedback was given, and today more custom feedback was given in the open fields. This open feedback is interesting, also for students who are giving the feedback session.
R1: Did you encounter any difficulties yourself when using the tool?
E: Real problems not I think
R1: Or something that you missed whilst using the tool?
E: An additional box where I can send the most important points to the students. Sometimes I think about something that is really not relevant during the micro teaching, but very relevant for the session next week. Now this is not possible in the tool. I think it would be really nice if this information can also be added to the report besides the feedback that the students have given, and not what I did now, is I send the students a mail with some pointers, so I'm giving them feedback on two channels.
R1: You already told me that you watched the video recordings which you made of the control group, you noticed that the quality of feedback was a lot lower in this group, and that you missed your own presence there to give suggestions to these students.
E: Yes that's right. It is ofcourse a group of first year students, who are not as far as students from the second year. I do not really think that the feedback tool would have a big impact here, but mostly the presence of an educator. Students do not always give musical pedagogical feedback, but more how active they were and how much they like the session. They liked it, so the activity was good, however the goal of the activity stretched further than it being fun.
R1: Yes you already named an example of this, that there was one activity which was not good musically, but that the students thought it was fun, which in term meant that the musically insufficient micro teaching only got good feedback.
E: Yes, when I heard the students afterwards they were really happy with their microteaching, and what they are going to add next week to the class, and when I looked at the activity afterwards, I thought that it did not have a lot going for it. I find it remarkable that they did not get this insight on their own. Can I come back to one question? To the question of what problems students encountered whilst using the tool, [STUDENT_NAME] was really involved, multiple times he provided written feedback to, but all the time at the same question because you can not give multiple answers. This means that you can also not forward it, because then you have to forward the whole bunch. He answered the same question for three different moments in microteaching. Is there a possibility to give written feedback, and then have a new place to give another piece of feedback to the same feedback criteria?
E: Yes, we also heard this in previous experiments, and this was meant to be implemented in the

system before this session, but due to time constraints it was not possible to do so.
R1: Do you have any other suggestions or notes?
E: I think that this tool becomes more useful when you use it more in your class sessions. I think that this one time use does not necessarily have an impact on the students, if the tool is released and I can use it for an entire year, I think that the tool would work. How experienced a student is with the tool, influences how effective it is.
R1: So you think that there is a learning curve to the system?
E: Yes, on the other side, yesterday I was asking myself the question, in what capacity is a first year student who is microteaching able to implement the feedback into their microteaching that is whispered to them. I think that for me as an educator it is important to keep the whispers to a minimum, and only send them what I want to see changed. I think that if they practice with the tool, they will pay more attention to the laptop screen whilst they are giving micro teaching sessions. Then they will see the added value of receiving feedback during their sessions. So I think that the system will really pay off when you use it systematically.
R1: Do you feel like the tool was a good addition for the feedback, or do you think that they would be just as good off with verbal feedback?
E: I think that it was really relevant during one session, and that was yesterday, with the students who did pay attention to the laptop. When I sent feedback, I immediately saw improvements in microteaching. I think that is the biggest added value.
R1: So for you, the added value is mostly in the receiving of feedback, and less in the giving of it.
E: I think that receiving feedback is a bigger added value, but the giving of feedback was definitely valuable. I think that the second year students were more activated with giving feedback. That was less for the first year students. The first year students were following the activity, and gave feedback afterwards, today with the second year students, people got their phone out more often. I also noticed that during the last session of today, the first part took quite long, and needed some guidance. This group gets our their phone and gives the feedback to the presenting student. So with this group I find it definitely an added value, but the first group of first year students would need to get some experience with the tool.
R1: You said that you think that the tool will be used differently based on the experience that the students have in their respective fields, do you think that the tool should work differently for these two groups of students?
E: The way of using should be the same I think, but maybe differentiation is needed in the questions which you let them answer.
R1: We already thought about implementing something like this, that you can insert for example 3 different levels of feedback criteria in your set, and that a level can be picked at the beginning of a session. Is something like this desirable?
E: I think so. And is it the educator, or the students themselves who picks the level?
R1: We are not really sure about this yet, maybe even both, that an educator can overrule it.
E: Yes, to let the educator overrule it seems like a good idea to me. However, when you get further in your education, the students tend to get more involved with the education. Sometimes in the first year, students notice that they have picked the wrong study, and then they start leaning back, and they might then pick the easier questions. I think when you get to the higher years in this education, students will seek more challenges and want to give more elaborate feedback.
R1: Do you have any more questions, or something that you want to add (To R2)
R2: Not really
R1: Thank you, then I will stop the recording now.

Appendix AB. Notes interview educator LUCA 2

The students gave more focussed feedback, this was because of the criteria. In regular sessions, the feedback is more like tips or tops, and the educator tries to give focussed feedback. The students told the educator that they felt like they got more focussed feedback.
These feedback criteria might not be as relevant for other micro teachings. That is why it was really nice that we made custom criteria for this micro teaching session.

It might be nice to have a textfield where the students can give free text. It might also be interesting to let the students do this after the session instead of during the session.

The creation of the summary was too time consuming, and put a lot of pressure on the presenting students. The creation of the summary left other people without any work. The students told the educator that they found the creation of the summary not really helpful. They thought that it would be helpful if they could create the summary at home. This lets them take more time.

One student did not have an eye for the laptop. When she went to the laptop, she still saw the black screen. She expected to see the feedback there. It might be a good idea to have a possibility for the student to rewind the given feedback.

The feedback tool is an addition for the students. It requires cognitive attention. This might be challenging for new students, since they already have a lot on their hands when they have to give a micro-teaching. I think that if we would do this on the master, that the students would look more on their laptop to see if the educator sends any whispers.

During the first session, there was not a lot of time to give feedback, this is why there was no verbal discussion of the feedback and it was solely given through the tool. Even though this was the case, the students still went home with “a treasure of information”, because the quantity of feedback increases significantly by using the tool. So, if you do not have a lot of time to discuss feedback, the students still get a lot of valuable information. But in ideal situations, there is more time to have an additional verbal conversation about the feedback after every session. This is also important to catch misconceptions.

The educator saw that the control group was the group who made the least adjustments to their workshops after the micro teaching sessions, even though they did not have the best micro-teaching sessions. She asks if these students would have given better feedback if they had used the feedback tool, without an educator. She thinks that it would’ve led to more insights into the possible improvements for these students.

It is also interesting for an educator to see what feedback students give to each other. Some students give less feedback, or feedback with less depth. It might be nice to see what feedback they give so that it is possible to help them learn how to give proper feedback.

For shorter micro teaching, one click answers might work but textual answers might be challenging according to the educator.

It is very challenging, even for experienced educators to let students give good, focussed feedback to

each other. It should be focussed, clear, and about the core of the activity. The tool helps with this.

Appendix AC. Results survey experiment group LUCA Lueven

Wat was jouw inlognaam op de website? (eg. LUCA-5)

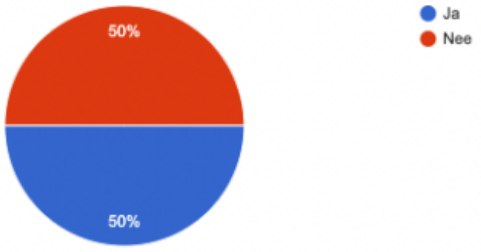
10 responses

Luca-5 en Luca -8
1-LUCA
3@luca.be
Luca2
6-luca
11-luca
LUCA-20
15
17@luca.be

Was de website het juiste middel om feedback te geven in deze setting?

Copy

10 responses



Welk middel was gepaster geweest om feedback te geven in deze setting?

5 responses

Live feedback
De leerkracht die direct feedback geeft, want wijzelf konden niet direct feedback geven met dat we fysiek bezig warden.
Iiets waarbij de leerkracht het kan zien als die door de klas loopt.
Ik vond het onpraktisch een gsm erbij te pakken/anderen dat te zien doen terwijl je probeert ze te engageren
Misschien meer als tool tijdens de micro teaching (je hebt iets van feedback dus je klikt snel op een knop - en op het einde kan je die dan mondeling uitleggen = nu was het heel erg beperkt omdat het allemaal met de gsm moest)

Kan je je een andere context voorstellen waarin de technologie meer gepast is?

5 responses

Stages voor leerkracht middelbaar

Op stage of een micro teaching waar je zelf niet fysiek bezig moet zijn

In een minder beweeglijke activiteit, waarbij de leerkracht niet veel rondloopt.

Waar leerlingen minder mee hoeven te doen, of bijvoorbeeld hun laptop al gebruiken/open hebben staan

Als docent achter aan een klas - dan heb je hier ook echt de tijd voor

Wat deed het geven van feedback met jouw betrokkenheid bij de microteaching sessie?

Copy

10 responses

Waardoor was jij meer of minder betrokken?

10 responses

Doordat je wist welke vragen je ging moeten beantwoorden kon je concreter volgen en opletten

Ik merkte dat ik tijdens de workshops zelf niet zoveel feedback gaf op het toestel, maar wel intenser nadacht over de feedback na de sessie.

door de feedback tijdens de microteaching was je soms afgeleid van de les

Door de groep dat enthousiast mee deed

Als je op je GSM zit kon je de opdracht zelf niet meer goed volgen

Ik kreeg geen feedback tijdens de microteaching door

Ik vergat dat de tool er was.

-

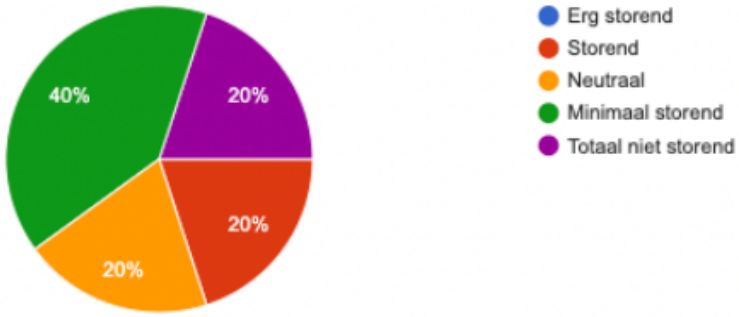
Het was moeilijk om met de juiste feedback te vinden

Omdat ik aan het denken was waar mijn gsm was en die opzetten om feedback te geven = minder aanwezig tijdens de uitleg

Copy

Hoe storend vond je de technologie in de klas?

10 responses



Indien van toepassing, wat vind je storend aan de technologie?

4 responses

Zeker omdat het in een kleinere groep is, was je gsm bovenhalen soms niet zo handig, omdat dan een groot deel van de groep uitviel. In grotere groep was dit minder een probleem

Het is iets extra om aan te denken als leerkracht.

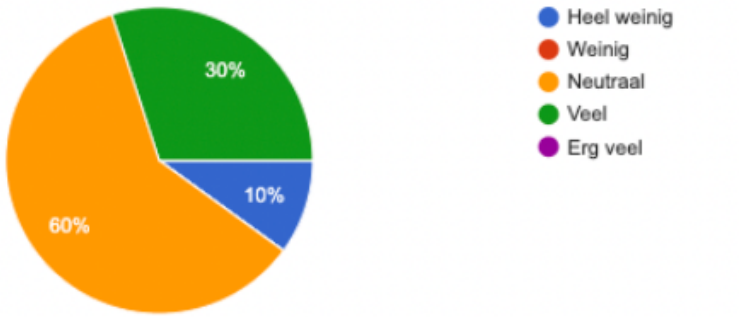
Ik vind het pakken van je gsm tijdens een (lichamelijke) activiteit

Het was voor mij nog een afleiding - misschien iets met een groen licht achteraan de klas = als er een melding is (zelf kiezen om te gaan kijken of niet)

Copy

Hoeveel heb jij geleerd van het geven van feedback?

10 responses



Op welke manier heeft het ontvangen van feedback bijgedragen tijdens het geven van de micro-teaching?

10 responses

Heel handig, loopt er iets mis of minder goed kan je er ook meteen op inspelen, en complimenten geven ook een extra 'yes ik ben goed bezig' boost

Het was goed dat we Loes' feedback zagen tijdens de sessie, dan konden we in real time aanpassen.

Je krijgt direct een duidelijke evaluatie van de micro-teaching

Achteraf om de echte les beter te kunnen plannen

Niet omdat er geen feedback door kwam

/

Ik ontving geen feedback

Ik heb ervoor gekozen weinig te kijken, omdat me dat uit mijn flow haalt

Omdat ik vaak aan de piano zit, was het moeilijk om de feedback te zien, achteraf wel handig

Ik heb zelf niet echt feedback gehad = alles was gericht op mijn partner

Op welke manier heeft het geven van feedback bijgedragen tijdens het volgen van de micro-teaching?

10 responses

Je was iets concreter aan het volgen niet enkel wat er gegeven werd, maar ook hoe

Tijdens het micro-teachen zelf heb ik het niet zoveel gedaan. Misschien was het handig geweest als we ook tijdens de sessie vrije opmerkingen konden typen. Soms voelde ik me beperkt door de vooraf opgestelde vragen.

je kan direct feedback meegeven zodat je die later niet vergeet

Goede commentaar achteraf

Minder aanwezig bij activiteit

Ik keek meer naar hoe ik de les ervaar dan hoe deze werd gegeven

Ik had weinig aandacht voor de feedback, dus de involved was beperkt.

Ik kan minder meedoen

Je denkt het er wel meer overna

Ik vond het wel duidelijk dat er categorieën waren - maar misschien eerder met pictogrammen werken in 5 categorieën die vaak aanbod komen volgens studenten - en zo een manier om makkelijker feedback vast te leggen zonder uit de activiteit te gaan

Welk onderdeel van het feedbackproces was voor jou het meest waardevol en waarom?

10 responses

De feedback tijdens het lesgeven

Het feit dat je als uitvoerder een duidelijke lijst krijgt met uitgetypte feedback van de anderen. Je krijgt veel meer feedback op deze manier, omdat iedereen individueel nadenkt. Wanneer we gewoon verbaal feedback krijgen, zijn het altijd dezelfde die antwoorden en krijgen we van veel studenten helemaal geen feedback.

Dat er concrete vragen worden gesteld om feedback te geven, dat is gestructureerd en duidelijk

De opgeslagen nabespreking

De samenvatting dan Kan je zelf een review doen

Het doornemen van de feedback na de les

De mogelijkheid om snel bij te sturen is een interessante Les.

Het bespreken van het overzicht achteraf vind ik waardevol.

Ik heb het meest uit de eind evalutatie gehaald

Dat je je feedback in realtime kon geven

Waar ben jij tegenaan gelopen tijdens het feedback proces?

10 responses

Het geven van feedback tijdens dat je volgt is soms nog wel wat onwennig, maar ik denk dat dat met vaker gebruiken wel betert

Ik vond het jammer dat we geen/weinig feedback nog verbaal krijgen. Kort na de online sessie enkele dingen bespreken was wel handig geweest, zowel om feedback te geven of te ontvangen. Zo kunnen we nog iets meer nuanceren (of door te communiceren met andere denken we nog eens na over bepaalde zaken).

/

Beperkte antwoordmogenlijkheid

nergens

Soms moet je even stoppen met de les te volgen om de feedback te kunnen geven

Ikvond het wat storend. Het voeldenals iets dat bovenop Al de rest kwam, maar er niet echt meer in paste.

-

Door het scrollen is het overzicht van de verschillende feedback

Ik kon niet echt alles zeggen - vaak maar over 1 persoon of deel. Daarnaast was er erg veel focus naar de tool gegaan en minder naar de feedback zelf - maar dat is in het begin zeker normaal

Wat zou jij graag anders willen zien?

6 responses

1) meer mogelijkheid tot open feedback 2) na de online feedback ook in het echt feedback geven

meer verschillende vragen, open vragen

Vrije feedback kunnen geven tijdens de les via de website

Ik zou het zelf echt implementer en dat de leerkracht feedback geeft of het meer in algemene micro teachings wordt gebruikt idpv in het muziekonderwijs

Een vlottere manier om het in de les te integreren.

Ik zou de feedback liever op een computer invullen, gsm is voor mij te klein enniet overzichtelijk

10 responses

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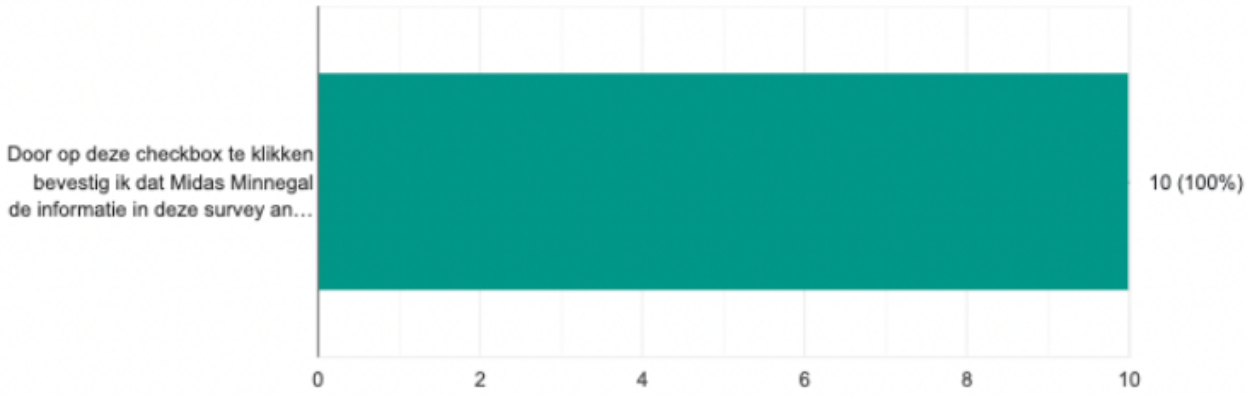


Appendix AD. Results survey control group LUCA Leuven

Waar ben jij tegenaan gelopen tijdens het feedback proces?

4 responses

Het feedback geven want is soms onduidelijk of alles aan bod is gekomen

Nergens

Onnodige/nuttige feedback

moeilijk om eigen feedback duidelijk te verwoorden

4 responses

Copy

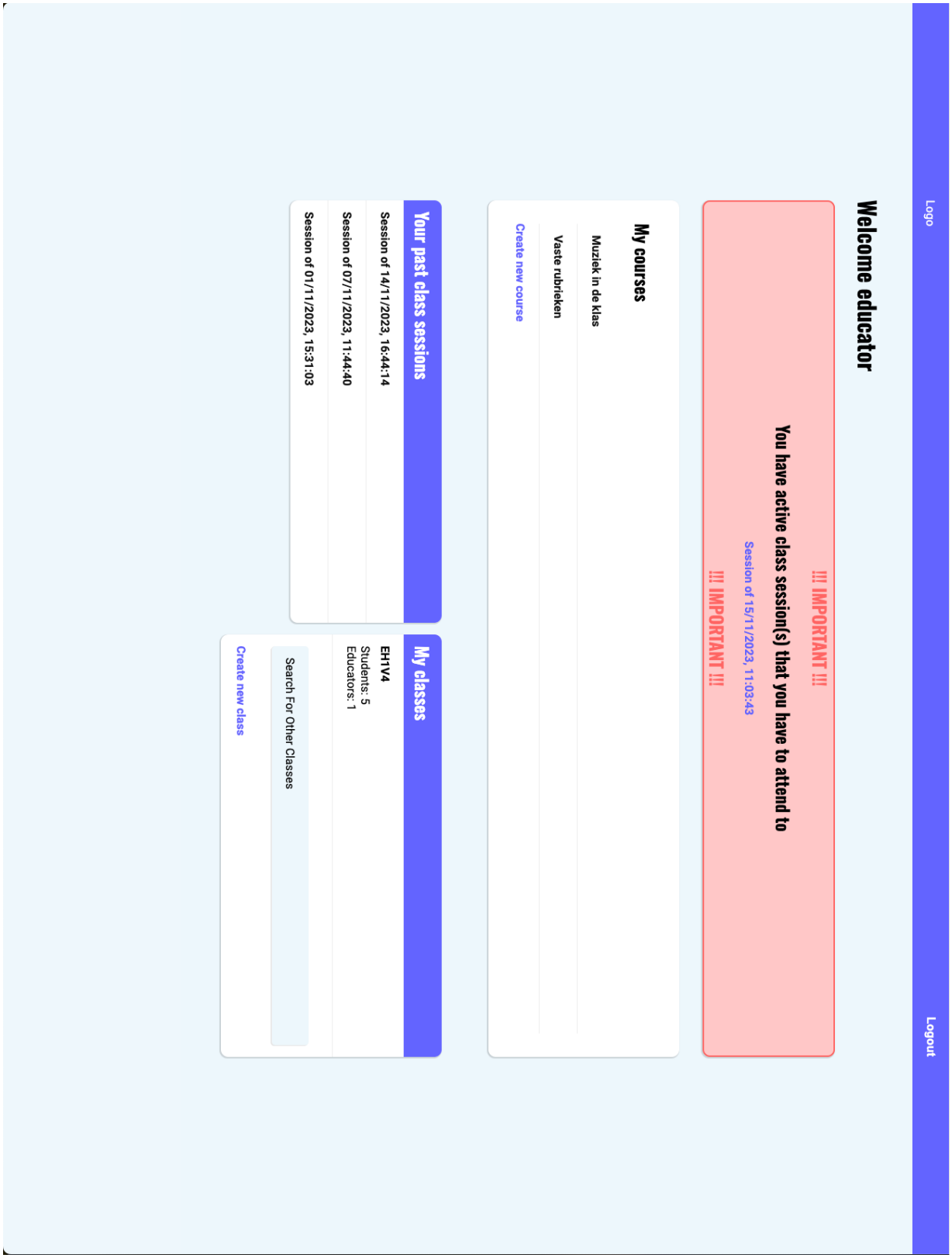
Appendix AE. Class diagram

The diagram is too big to fit properly on a screen, you can open the full svg file via the link below, or by scanning the QR code.

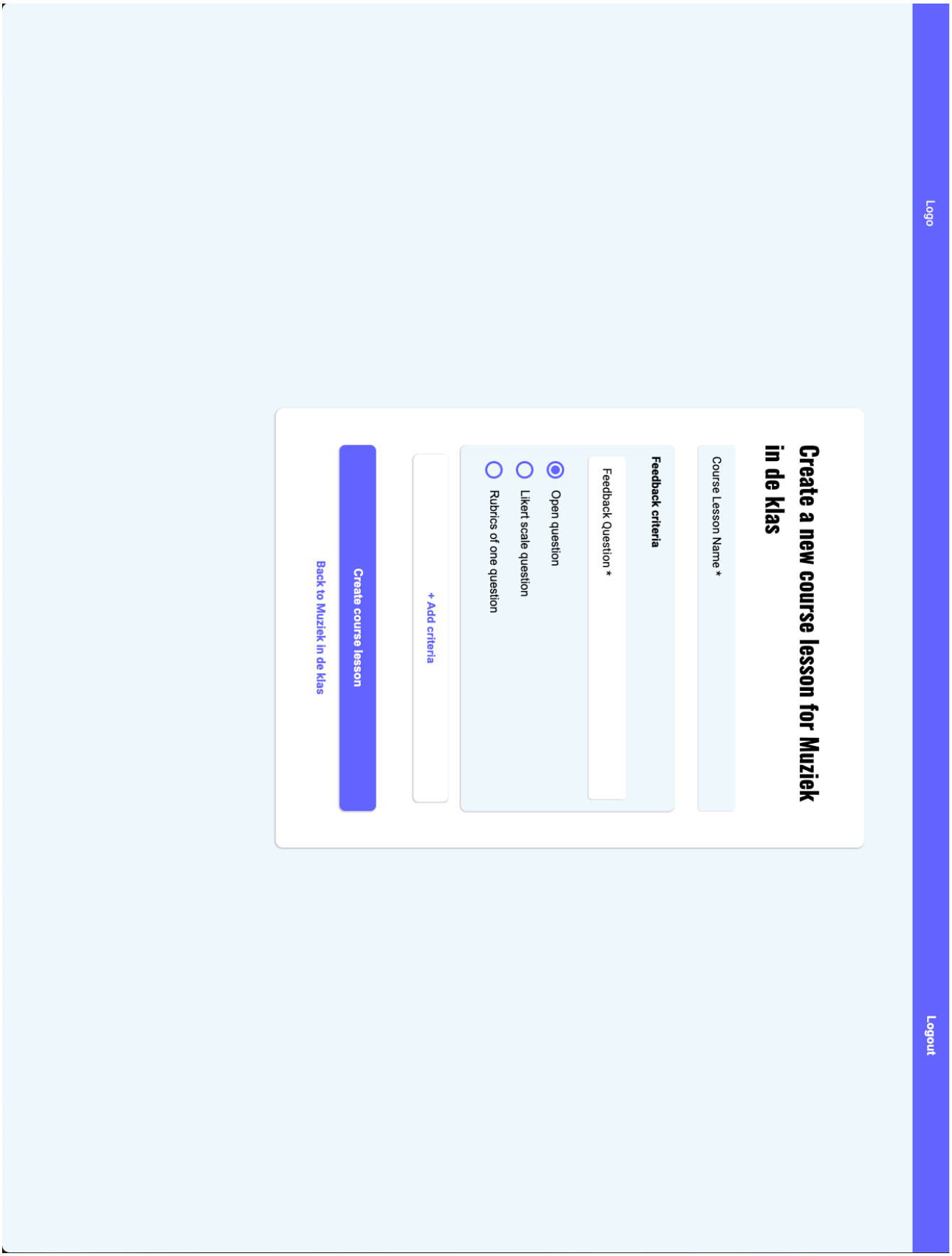
https://drive.google.com/file/d/12jGYYp1Inz3tEyLgbxwUCitRcr4vPPKn/view

Appendix AF. Old design (most important pages)

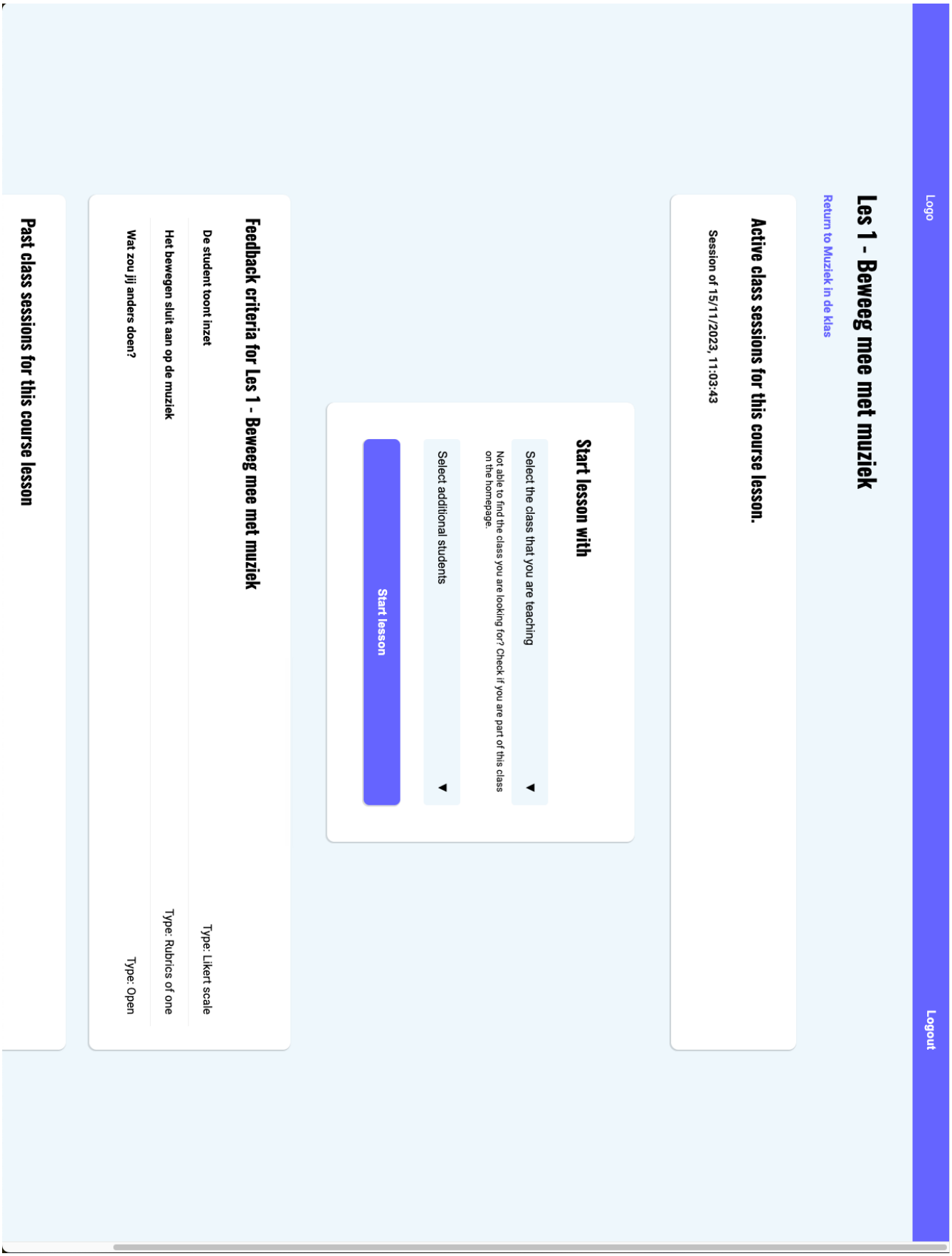
Homepage design with an active class session



Create feedback set form design (Previously known as course lesson)

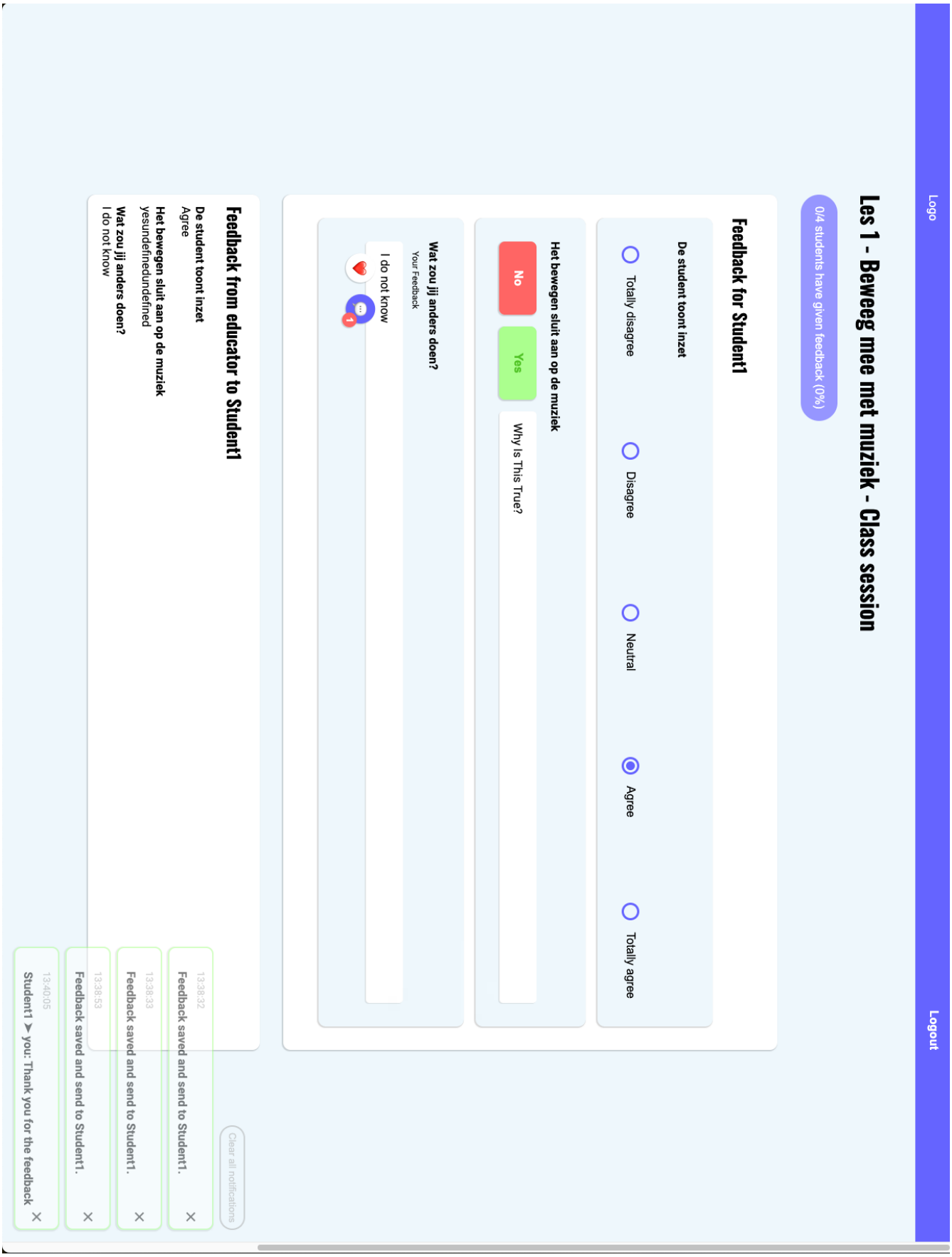


Start class session (In new design on the homepage)

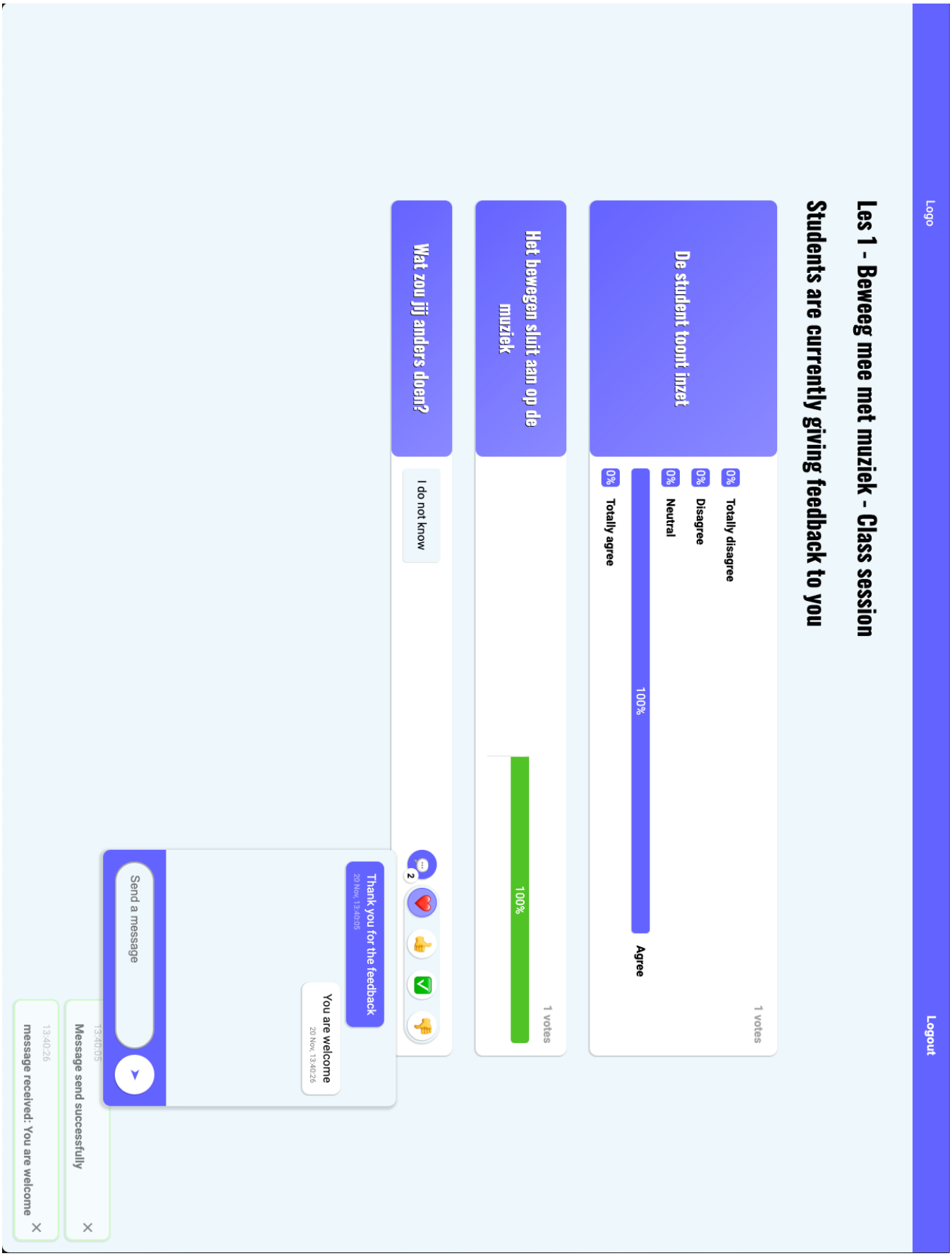


An active class session from educator perspective

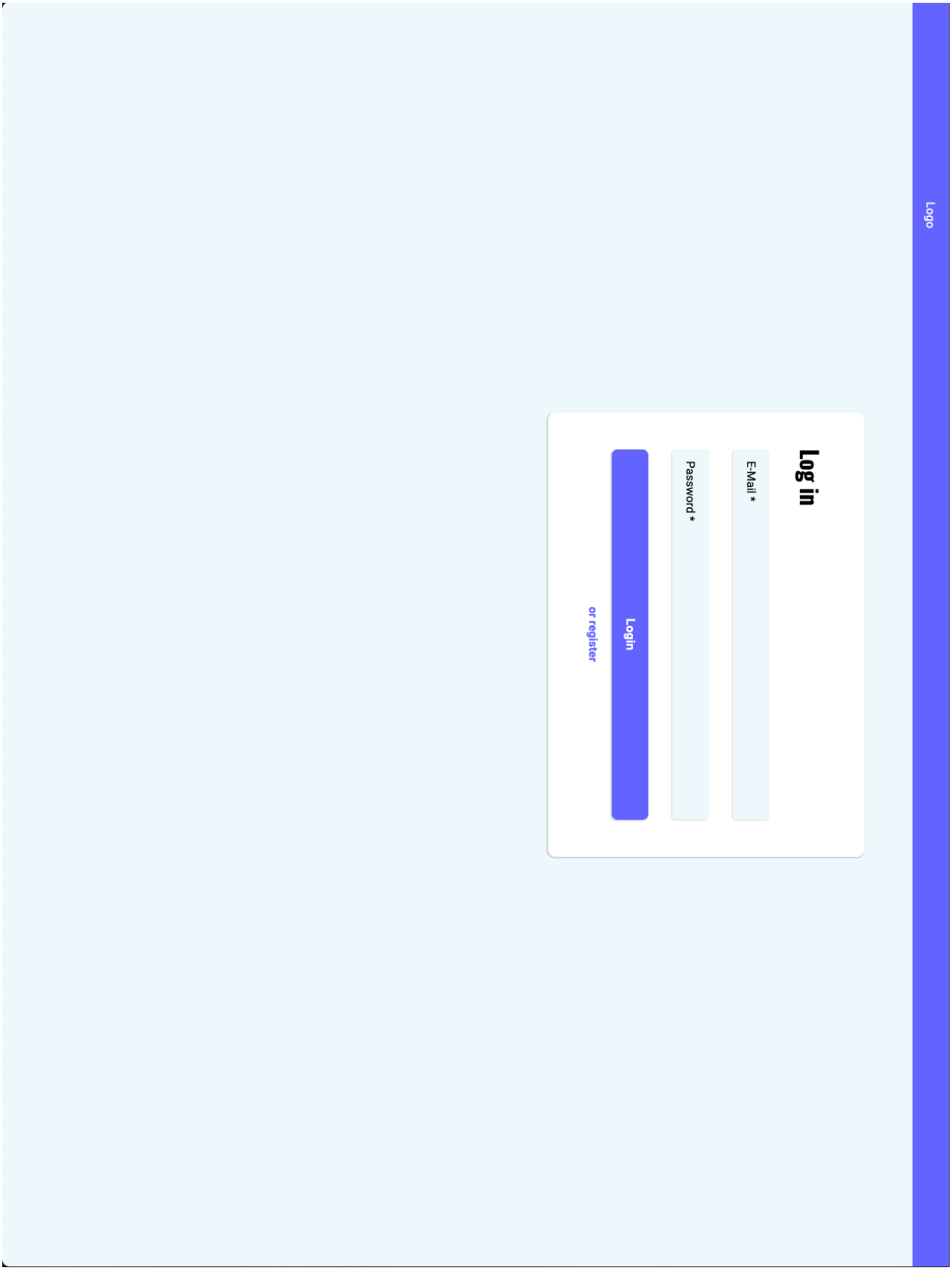
Giving feedback (Educator perspective)



Feedback overview (one chat open)

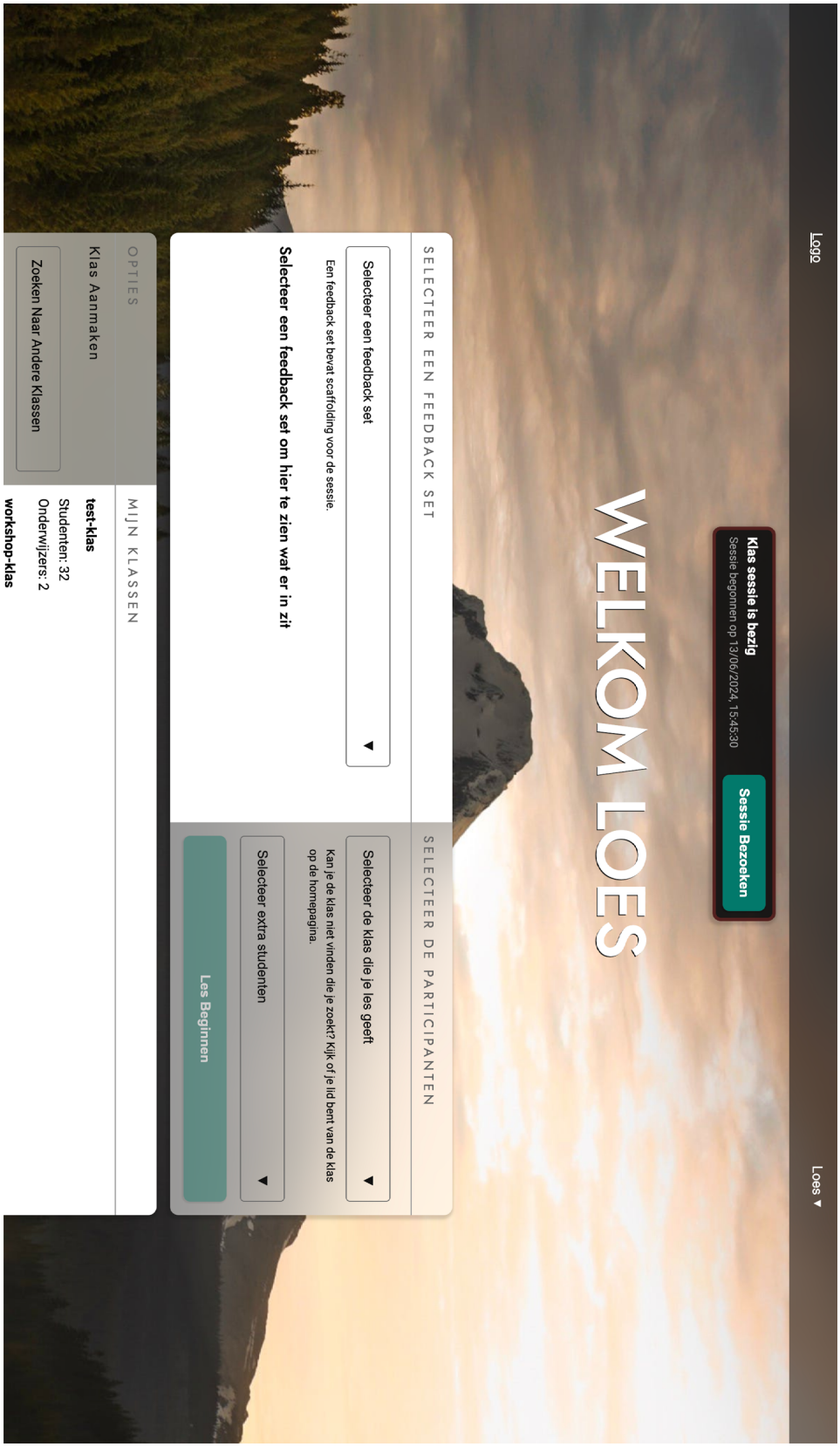


Login form

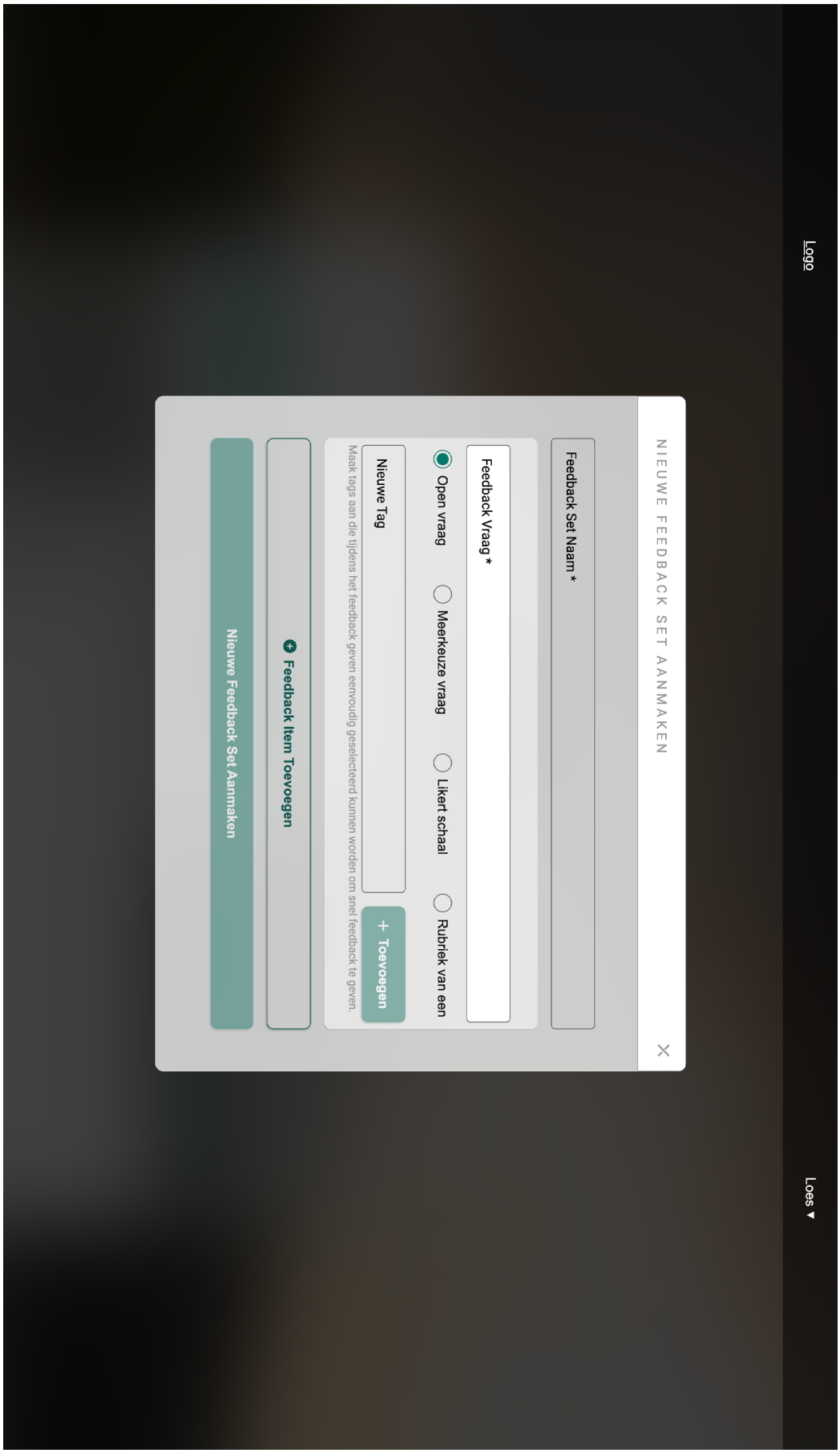


Appendix AG. New design (most important pages)

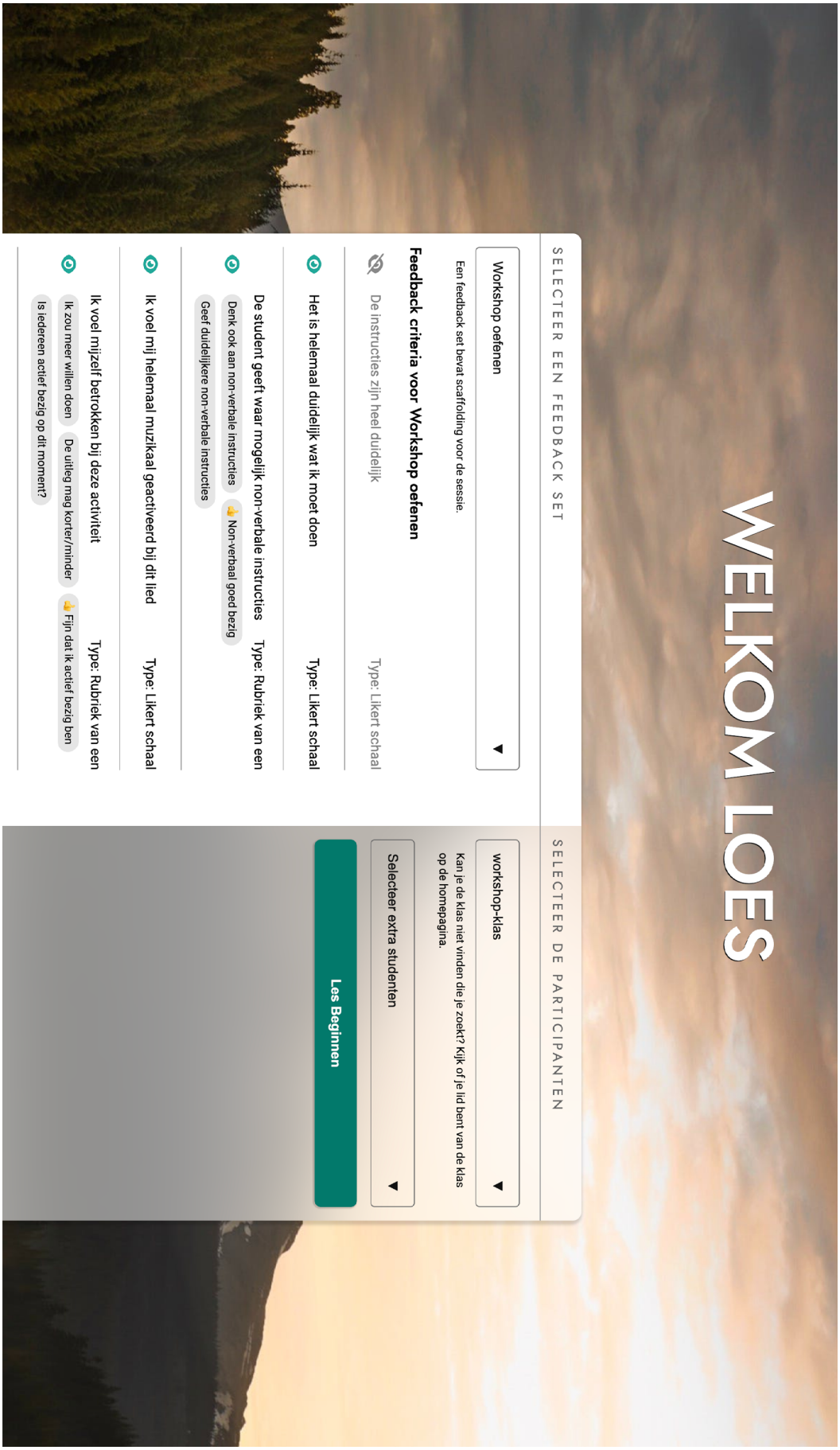
Homepage design with an active class session



Create feedback set form design

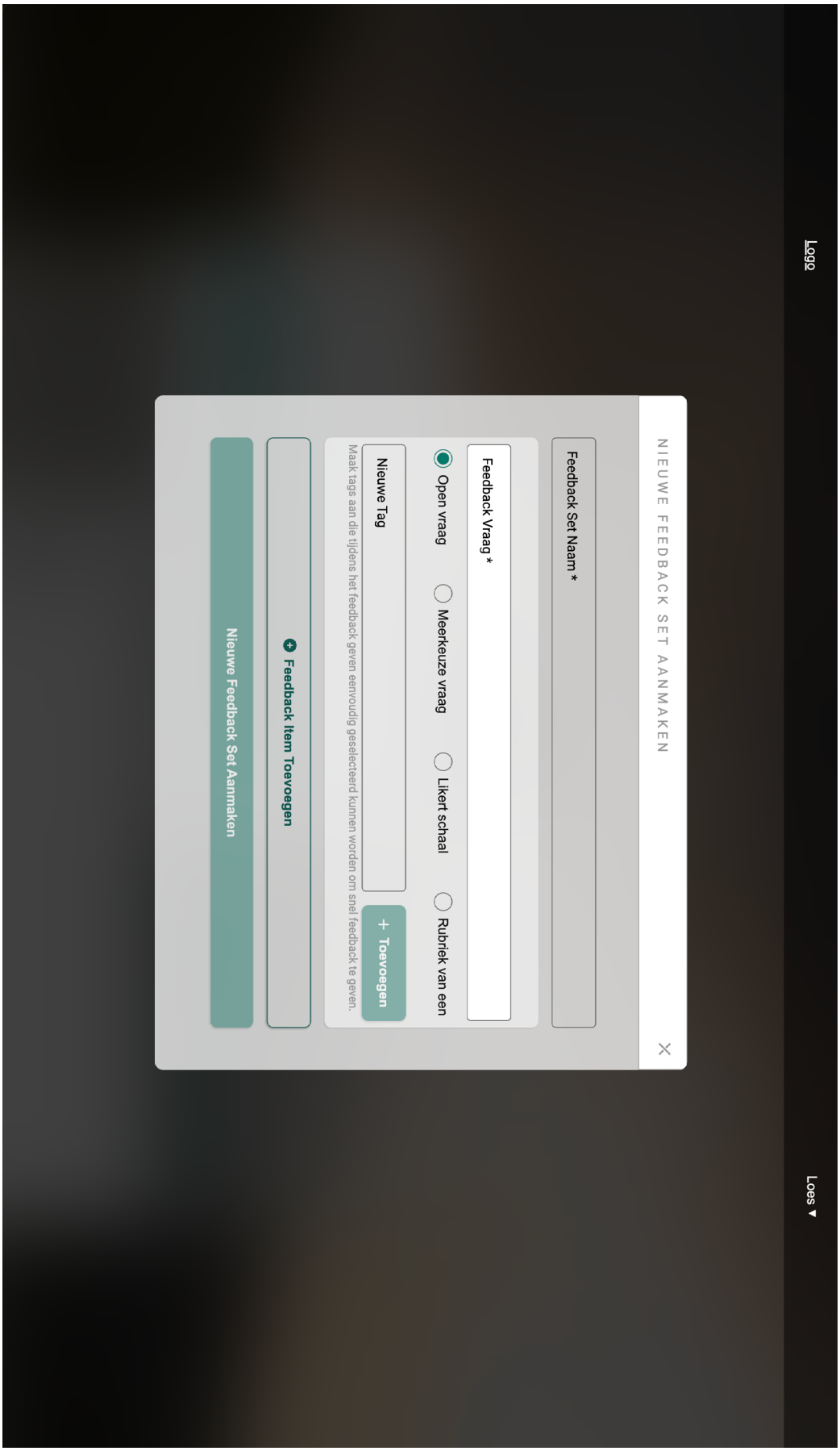


Start class session (On homepage)

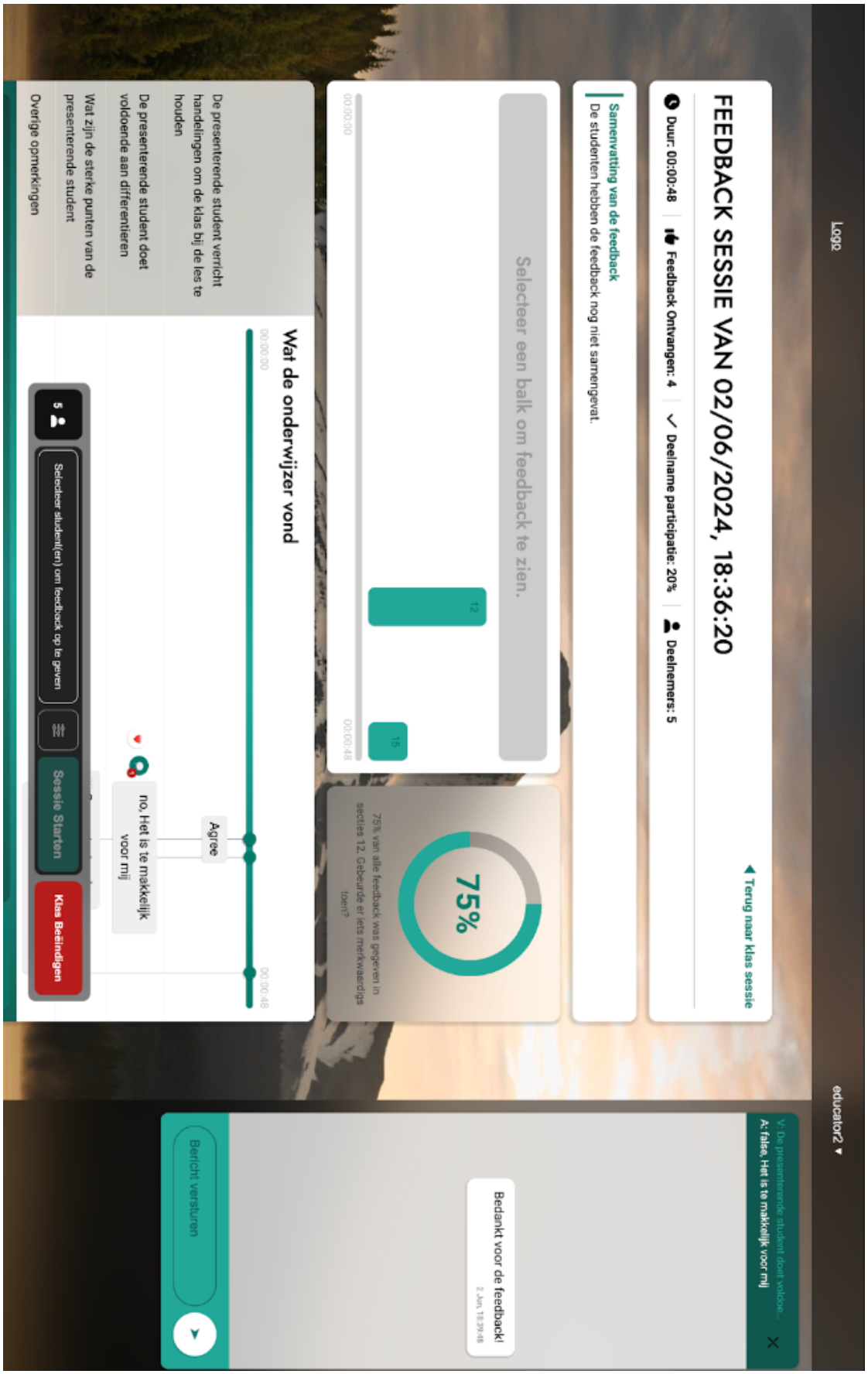


An active class session from educator perspective

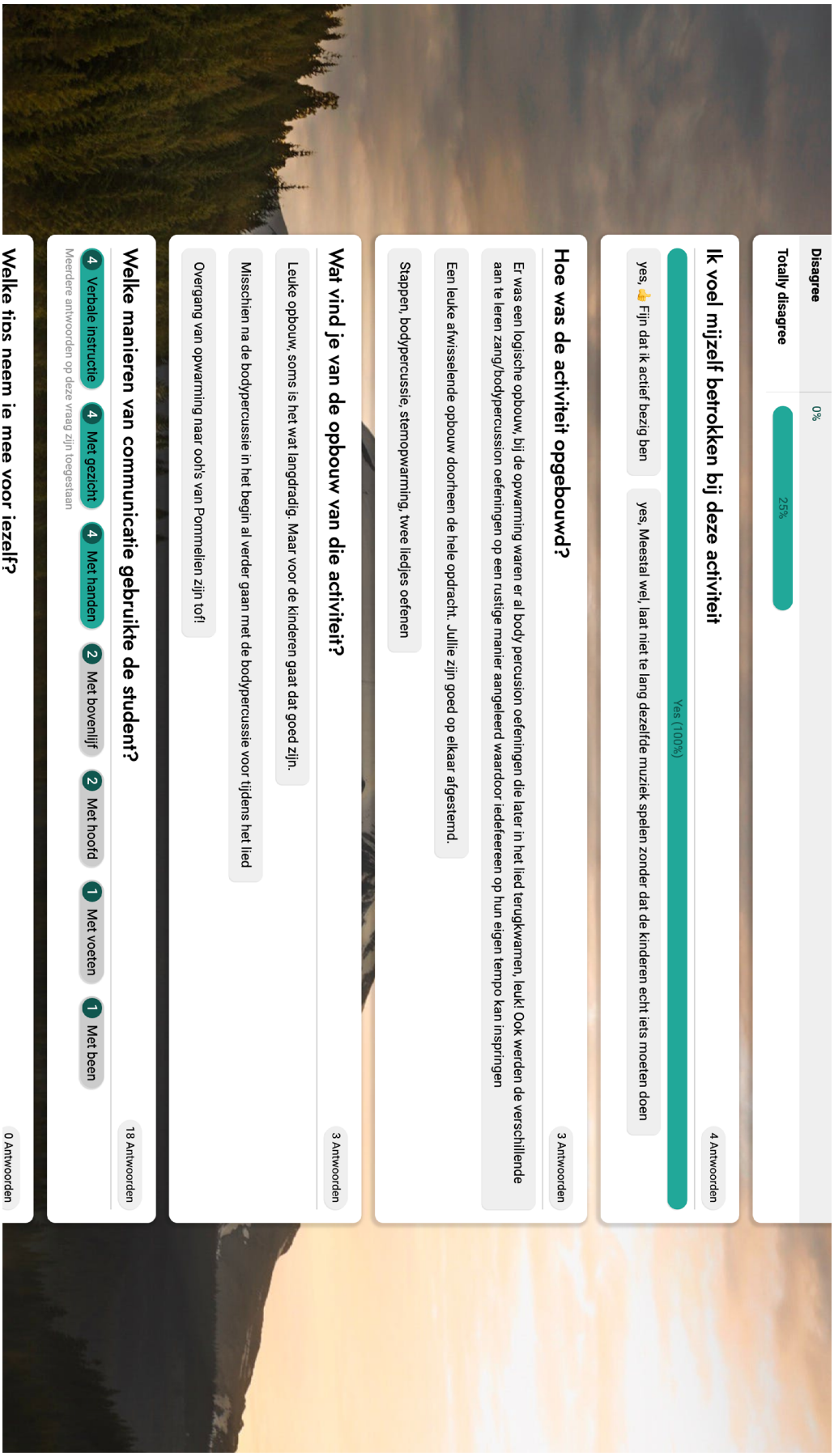
Giving feedback (Educator perspective)



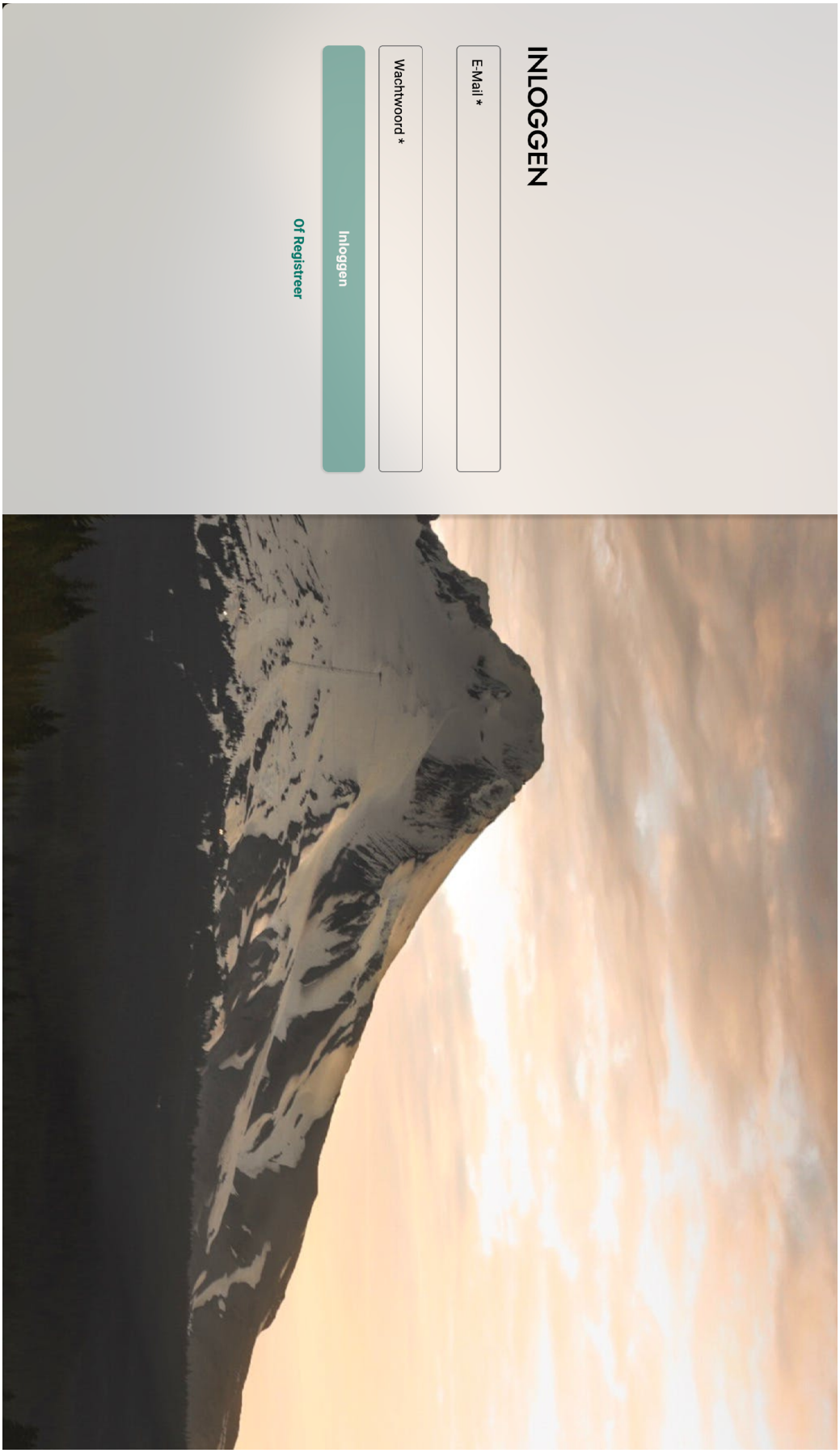
Feedback overview top (Educator perspective with chat open)



Feedback overview scrolled down (Educator perspective)



Login form



Aknowledgement

I have always been passionate about music. I started playing the guitar when I was nine years old. Later on in my life, I developed a deep passion for technology and design. I'm grateful for the opportunity to combine these two passions during my thesis.

I want to thank everyone who took time out of their day to help me make this thesis. People who let me interview them, educators who threw around their entire lessons to facilitate my experiment, people who gave feedback on my thesis, and people who were not directly involved in the project who assisted me during an experiment.

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For me, this journey has not ended yet. I'm looking forward to seeing what the coming years have to offer, and how we are going to expand Edufade together with Benno. This is not the end of the book, just the beginning of a new chapter.

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