Toward personal and emotional connectivity in mobile higher education through asynchronous formative audio feedback

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Abstract
This study aims to develop asynchronous formative audio feedback practices for mobile learning in higher education settings. The development was conducted in keeping with the principles of design-based research. The research activities focused on an inter-university online course, within which the use of instructor audio feedback was tested, analyzed and developed further. Participants in this study were students (n = 50) from four Finnish universities who enrolled in the 7-week course. The teaching approach of the course could best be characterized as collaborative case-based mobile learning. Furthermore, we employed a novel formative audio feedback practice that has been inspired by and follows the peer-review practices employed by scientific journals. In particular, we wanted to find out how students experienced the use of audio feedback in terms of utility, emotional support and learning. Research data was gathered through a questionnaire to the course students, transcribed audio feedback provided for the students and students’ performance results. The study indicates that the novel formative audio feedback practice was successful in promoting the emotional engagement of students and personal connectivity between students and instructors. Furthermore, the audio feedback proved effective in terms of assignment revisions, and also in terms of students’ self-reports of the meaning of the audio feedback for learning. The majority of students welcomed the audio feedback, and also expressed a wish for the integrated use of text and audio. Therefore, in future implementations, we will integrate the audio and written feedback.

Introduction
Meaningful instructor feedback is one of the most powerful means of empowering students, as well as enhancing and transforming their learning (Hattie & Timperley, 2007; Nicol & Macfarlane-Dick, 2006; Van der Kleij, Feskens, & Eggen, 2015). In a review of research on the impact of feedback on learning and achievement, Hattie and Timperley (2007) defined feedback as “information provided by an agent (eg, teacher, peer, book, parent, self, experience) regarding aspects of one’s performance or understanding” (p. 81). Research literature and practical experiences of blended and online teaching indicate that the ways students receive feedback from their fellow students and instructors need development in terms of its quality, detail and timing.

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(eg, Dixon, 2015; Lunt & Curran, 2010). Feedback practices that are more emotionally engaging must also be developed (Crook et al., 2012). Students’ emotions in academic settings play a central role in their motivation to learn as well as academic achievement (Op’t Eynde & Turner, 2006), and feedback provided by instructors is one of the generators of students’ emotions (Rowe, Fitness, & Wood, 2014, 2015). Students’ positive emotions predict high achievement, and negative emotions such as anxiety, anger, boredom and shame predict low achievement (Pekrun & Linnenbrink-Garcia, 2014). Well-timed, detailed, specific and positive feedback can empower students during their learning processes through emotions such as joy, pride and excitement (Rowe et al., 2014) and lead to better learning outcomes as instructors have the possibility to step into a student’s learning process and potentially change the direction of the process or deepen it.

Students demand increased individual feedback. Due to worsening staff-to-student ratios and the increasing workloads of academic staff, high-quality technology-supported pedagogical practices must be developed to help instructors provide feedback efficiently and in pedagogically sound ways (Glover, 2012; see also Crook et al., 2012; Dixon, 2015; Mayhem, 2016; Parkes & Fletcher, 2014). In a digitized world, these practices need to match with the core of mobile learning, ie, to promote connectivity and flexibility between people, contexts, contents, times, places and
methods of learning (Crompton, 2013; Sharples, Sánchez, Milrad, & Vavoula, 2009). There have been numerous initiatives for developing audio feedback practices in higher education (HE) settings (see, eg, Dixon, 2015; Nortcliffe & Middleton, 2007), and technology-supported feedback tools, as well as digital applications, have been developed and/or tested (eg, Crook et al., 2012; Glover, 2012; Mayhem, 2016) to help instructors provide students with asynchronous multimodal feedback. With the help of these applications, instructors can provide feedback to individual students, small groups of students, or even the whole class (eg, Borup, West, & Thomas, 2015; Crook et al., 2012).

The use of audio feedback by instructors is, therefore, nothing new, and has been available and recommended for teachers from the 1980s onwards with the technologies of that time (Dixon, 2015). There is a growing amount of research literature pointing out to the ways that audio feedback could be used in teaching, but presently we need to shift the focus to the lived experience of students receiving audio feedback (Dixon, 2015). A critical question is also, whether the power of audio feedback relies upon previously established relationships between the instructor and student, ie, is it experienced as personal if it comes from an instructor students do not know (Woodcock, 2016) and have never seen face-to-face.

This study is based on a social constructivist understanding of learning, in which the notions of learner-centeredness, process orientation, collaboration, students’ emotional involvement, teacher feedback and the development of curricula and assessment are key notions (eg, Ruokamo, Hakkarainen, & Eriksson, 2012; Tynjälä, 2001). This study provides new insights into research on the use of audio feedback in mobile learning settings. The site of this study was an online inter-university course resorting to collaborative case-based mobile learning during which student groups collaboratively explored and analyzed real life cases. First, the study reports on students’ experiences of asynchronous audio feedback from an instructor they do not know, and will not meet face-to-face. Second, the study presents a not previously reported formative audio feedback practice that has been inspired by and follows the peer-review practices employed by scientific journals.

Next, recent studies on students’ and instructors’ experiences of using audio feedback in blended and online HE settings are presented, followed by a presentation of a design-based study of an online inter-university course at the Faculty of Education at the University of Lapland, Finland. The students in the course were teacher students (primary and adult education) or students of educational sciences. The course functioned as a site for developing and testing mobile asynchronous audio feedback practices. The results of the research can be utilized in developing the course further but also more generally in developing HE pedagogies and learning environments.

Previous research on audio instructor feedback

Studies indicate that asynchronous instructor audio feedback has been positively received by students and that they prefer audio feedback to written feedback (Parkes & Fletcher, 2014). Middleton (2009) presented results from a university-wide pilot designed to encourage academic staff to implement digital audio, including audio feedback, in their teaching practices. Based on the pilot, he concluded that if teachers are offered enough timely technical support, audio materials can help add a social presence and connectivity between students and teachers (see also Parkes & Fletcher, 2014). Other case studies indicate that audio feedback has been welcomed by students because, compared to text-based feedback, it is easier to understand, more personal and conveys more nuances and emotions (eg, Cavanaugh & Song, 2010; Merry & Orsmond, 2008; Parkes & Fletcher, 2014; Woodcock, 2016). Because of its reception by students as a more personal form of feedback, constructive criticism can be easier to receive (Woodcock, 2016). An
additional benefit of audio feedback is that, according to students, it has offered them insights into the grading process (Parkes & Fletcher, 2014).

Dixon (2015) reviewed research literature focusing on the practicalities of the provision of feedback, its technological and pedagogical affordances, and its ability to facilitate a sense of personal connection between instructors and students. The review was limited to the countries in which, according to Dixon, the use of audio feedback is predominantly practiced, that is, the UK, Australia and the USA. As to the practicalities, the review indicated no consensus in terms of whether audio feedback saves the instructor’s time. Clearly, this depends on how the feedback is provided. In terms of the delivery, many organizations prefer institutional virtual learning environment (VLE) tools for providing audio feedback. Furthermore, the majority of the research reviewed utilized a blended approach, meaning that traditional annotation of scripts was coupled with a summative audio recording. Students reported a preference for the integration of audio feedback and text commentary. The majority of the literature indicated positive student perceptions of audio feedback and its personal nature. Dixon concludes that the instructor’s personal voice, and especially the tone of voice may communicate meaning, care and personal attention and connectivity better than other feedback methods, and therefore promote the pastoral and emotional dimension of teaching and learning.

However, the weaknesses of audio feedback reported by students include difficulty following the feedback, lengthy time required to listen to the feedback, and difficulty skimming the feedback and returning to specific points at a later time (Parkes & Fletcher, 2014). A limitation of audio feedback is the fact that it does not include visual representations of the assignment, and therefore it is less clear to students which parts of the assignments the instructor’s comments relate to (Mayhem, 2016). Therefore, screen capture technology has been used to integrate the visual and audio information (eg, Mayhem, 2016). Parkes and Fletcher (2014) also pointed out that audio feedback may be experienced as too confrontational by some students because of its ability to convey negative emotions. Furthermore, some students prefer written feedback to audio feedback because they see themselves more as visual learners (Woodcock, 2016). Based on his review of research literature, Dixon (2015) stresses that several studies highlight that a minority of students do not welcome audio feedback because of its intrusiveness. As for the teacher experience, research suggests mixed emotions (Cavanaugh & Song, 2010) as well as positive experiences (Woodcock, 2016). Even if audio feedback is not substantially quicker to use than written feedback, audio feedback allows for substantially more detailed feedback than what could be provided by written feedback (Parkes & Fletcher, 2014).

**Developing pedagogy through design-based research**

Our study was conducted in keeping with the principles of design-based research (DBR) (the Design-Based Research Collective, 2003). DBR is generally a series of approaches for improving educational practices through iterative stages of design, implementation, analysis and refinement. The intrinsic characteristic is the close connection between theory and practice; all activities in the study presented here are based on close collaboration between research and practice (Wang & Hannafin, 2005).

Wang and Hannafin (2005) see participatory action research as being akin to DBR in that it involves collaboration between researchers and participants and aims at improving both theory and local practices. However, in participatory action research the local improvements typically derive from participants’ own research, which is only facilitated by the researchers and interventions are not designed and progressively refined with researchers in a collaborative way similar to that found in DBR. Also, in DBR the theoretically guided design process receives more attention than in action research (Heikkinen & Syrjälä, 2006). Ultimately, there are two critical differences
in the characteristics of action research and DBR that led us approaching our case through DBR. First, the ownership of research, ie, the instructors are the researchers, not the participants, and second our course was designed on a solid theoretical basis and through our work we aim to develop both theory and practice as they are considered tightly interwoven.

The close connection between research and practice produces the dual goals of DBR. First, it aims to develop new theories, artifacts and practices that may have an impact on learning (the Design-Based Research Collective, 2003). Second, DBR unfolds these for assessment and investigates the changes they suggest at the local level. Here, this meant considering how audio feedback can be used in mobile learning in HE. The authors of this paper served as the designers, researchers and instructors of the course where new audio feedback practices were implemented. Students participated in the process as co-designers. The initial course design and feedback practices were designed by instructors, but the design of the next implementation of the course is based on information students provided about their experiences of receiving audio feedback and the ideas they presented for future implementations.

This paper reports on the first cycle of an ongoing DBR study, during which audio feedback practices were designed for and tested in the course “Pedagogical Viewpoints on the Educational Use of ICTs” (four European Credit Transfer System credits) by the authors of this paper. The goal of the first stage was to (1) design audio feedback practices for the course based on current research knowledge, (2) implement the practices during the course, (3) collect data, and (4) use the data as the basis for further design. Many variables may affect the success of designed experiments, and effective pedagogical practices will develop only through subsequent refining and testing. Thus, the practices developed here must be implemented often enough to reach sufficient coherence. Real-world situations and contexts are complex, and reaching entire students’ and teachers’ experience is difficult, even with large amounts of varying data (Wang & Hannafin, 2005).

To respond to previously acknowledged need of gaining empirical knowledge of students’ lived experience of audio feedback in higher education learning (Dixon, 2015; Woodcock, 2016), especially in situations where the feedback comes from an instructor whom the students do not know (Woodcock, 2016), and to develop both the theory and practices of using audio feedback in higher education teaching through DBR, we sought answers to the following research questions: (1) In which physical spaces and with which devices do students listen to audio feedback? (2) How do students experience audio feedback and its meaning for improving their assignments and for learning? (3) How effective is the feedback in terms of the revisions the students make to their assignments?

**Research setting, design, and research questions**

Participants in this study were students \( n = 50; \) 40 female and 10 male) from four Finnish universities who enrolled in the 7-week online course “Pedagogical Viewpoints on the Educational Use of ICTs” that was implemented in September and October 2016. The course is an inter-university online course that is realized on the Moodle VLE. Students in this course are teacher students (primary and adult education), or students of educational sciences. The authors of this paper operated as instructors on this course as well as researchers in the study presented here.

The aim of the course is that students understand the meanings of information and communication technologies (ICTs) and new learning environments in teaching and learning. Students develop skills in assessing various ways to use ICTs from the points of view of learning theories, pedagogy and media education. The teaching approach of the course could best be characterized as collaborative case-based mobile learning. The concepts of “mobile” and “mobility” are understood...
here more widely than just using mobile devices in learning. In addition to being able to physically move between physical and virtual places, mobility can be regarded as a social, temporal and conceptual phenomenon (Crompton, 2013; Sharples et al., 2009). These different aspects of mobile learning were considered in the course design. The students were separated in physical place, since they were students from four universities in different parts of Finland. Therefore, a large part of the students did not know the online course instructors who could be from a different university than the students themselves. This provided an opportunity to look at whether students’ previously established relationships with the instructors would have an effect on how they perceived audio feedback (see Woodcock, 2016). To promote students’ contextual mobility and afford them the possibility of personalization (Crompton, 2013), students were free to independently form groups of 2–4 students based on their contextual interests. As a result, 17 groups were formed. Group members were connected to each other and the instructors through mobile ICTs of their choice.

Groups were assigned with a collaborative task to explore and analyze a real life ICT- or media-supported learning environment case in terms of learning theoretical principles, i.e., characteristics of meaningful learning (see Ruokamo et al., 2012) and produce a written case analysis. The case could be, e.g., an online/blended course, game, learning community or face-to-face course. Examples of the cases chosen by the groups include The Hour of Code global event (https://www.code.org/) and Ekapeli—an online Finnish game for learning difficulties in reading and mathematics (www.LukiMat.fi). The instructors’ role was to help inter-university student groups to get started in their learning process through asynchronous discussions realized first in the Moodle VLE. Moodle was also used for sharing course material and receiving groups’ finished assignments; otherwise students were free to use whichever tools and technologies they preferred in collaborative writing and communicating with each other. Groups were set with a rough schedule (two deadlines for returning assignments); otherwise they were free to schedule and organize their work independently among the group (Crompton, 2013; Sharples et al., 2009).

The assessment criteria for students’ case analyses were in line with Bloom’s taxonomy, as revised by Krathwohl (2002), in that the instructors looked specifically into how student groups understood the theoretical principles of learning that they were expected to apply to the case at hand, in other words, to analyze and evaluate their case based on the learning theoretical perspectives. In addition, the instructors paid attention to how accurately students described their case, and how they used and cited scientific references.

During the earlier implementations of the course, instructors had provided summative written feedback to student groups on their learning assignments through Moodle at the end of the course. Based on a review of the existing literature on multimodal feedback practices in HE, we decided to replace the written summative feedback practices with formative audio feedback. This was provided using the Vocaroo voice recording service. The length of the audio feedback files varied between 1 minute 27 seconds and 7 minutes 29 seconds. The purpose was to help student groups improve their collaborative assignments, and the feedback consisted mainly of suggestions on how to particularize and deepen their case analyses. Based on the feedback, the student groups were instructed to revise and edit their case analysis and explain the changes they had made in a separate document, very much in the style of scientific journals.

In general, the feedback and assessment practices were in line with suggestions given by Nicol and Macfarlane-Dick (2006). The assessment criteria were available for the students throughout the course and feedback was provided on work-in-progress and in relation to predefined criteria. The feedback was timely and students had an opportunity to reflect on it, and marks were provided only after students had responded to feedback comments. Distinctively to Nicol &
Macfarlane’s suggestions we did not ask students to present specific questions or needs on what they would like us to comment in particular, our students did not present them either. This might be something we need to reconsider and specify in future implementations to sharpen our focus and increase the meaningfulness of our feedback.

Characteristic of DBR (the Design-Based Research Collective, 2003), data were collected and analyzed through several procedures, for which we requested students’ informed consent:

- **A 7-item questionnaire to the student groups (n = 17).** The questionnaire included multiple-choice and open-ended questions with consequent sub-questions about where and how students listened to the audio feedback, and how did they experience the feedback. For example, students were asked: “What kind of emotions or thoughts did the feedback evoke?” The groups submitted their answers as a group. The size of the data from the open-ended questions was 4655 words. It was analyzed by coding and thematizing students’ responses with NVivo qualitative data analysis software. The analysis was conducted collaboratively by both instructors/authors to deepen the analysis and to strengthen the reliability of coding.

- **Transcribed audio feedback provided for the student groups (n = 17) by the two instructors/authors.** The audio recordings were first transcribed word for word by the instructors. The size of the data was 6931 words. The data were analyzed according to the instructors’ suggestions for improvement using NVivo. Each suggestion was coded into one of the following three categories: (1) Understanding and application of learning theoretical perspectives, (2) Description of the case, and (3) Use and citing of references.

- **Student groups’ (n = 17) written documents in which they explained the changes they had made to their case analyses, and student groups’ revised case analyses.** These were analyzed in terms of the number and quality of revisions that the students had succeeded in making to their assignments.

### Results

Students mostly listened to the feedback at home; some had listened to it at the university, in a bus or at their parents’ home. Typically, feedback was accessed through laptops. Smartphones and tablet computers were used equally, but clearly less than laptops. Possibly students listened to the feedback when they started to revise their reports with their laptops and therefore laptops were also the most common device used for listening.

Students’ experiences of the audio feedback were first coded into 17 thematic categories, (Table 1) that were then clustered under six categories: (1) Usability, (2) Quality, (3) Student-Teacher Connection, (4) Students’ Emotional Engagement, (5) Perceptions of Learning Process, and (6) Suggestions for Course Design.

The majority of the groups (n = 15) reported that the audio feedback was easy to use. The length of the feedback was perceived adequate, even though it varied quite a lot. Vocaroo produced files of satisfactory quality and there were only a few cases of having minor problems with the sound quality.

Audio feedback was perceived personal whether or not the students met with their instructor face-to-face, as the following quotes exemplify:

Audio feedback comes more toward oneself than written feedback. The voice spoke exactly to us:) (Group 4)

The voice perhaps helped in creating a more humane impression and in understanding the feedback, and it felt anything but not unpleasant. (Group 7)
There is “really” someone instructing this course (even though we’ve never met face-to-face, the voice gives you a closer impression of the instructor) (Group 12)

Audio feedback seems to promote students’ emotional engagement, as student groups reported experiencing audio feedback as “pleasant” \((n = 8)\), “not unpleasant” \((n = 1)\), and that the feedback generated “positive emotions” \((n = 1)\) and “a more interactive feeling” \((n = 1)\). However, one group reported having experienced “not very much trust” towards the Vocaroo application because of the advertisements hovering in it and a “constant feeling that a pop-up window will pop up straight in front of your eyes.”

In general, students perceived audio feedback beneficial for their learning. Students were provided with new viewpoints and guided towards a more analytical assessment of their cases. They perceived that audio feedback managed to mediate more information than text:

When compared to text, audio feedback includes in a way more of it. Instructor’s strain and intonation, excitement or monotone provide the one receiving the feedback additional information about what the instructor means. For example the word ‘good’ gains different meaning when it is said with a steady intonation, downward intonation, or by rising the intonation first and then descending it. When written, it is just good. You cannot (and need not) to interpret it the same way than if it is written. (Group 16)

Some students perceived audio feedback more demanding than written feedback. Finding the main points for revising their reports was perceived challenging, but this might have also

<table>
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<tr>
<th>Clustered nodes</th>
<th>Nodes</th>
<th>References</th>
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<tbody>
<tr>
<td>1 Usability</td>
<td>Audio File Did Not Work</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Audio File Was Difficult to Use</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Audio File Was Easy to Use</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>No Problems Using Audio Feedback</td>
<td>8</td>
</tr>
<tr>
<td>2 Quality</td>
<td>Adequate Length of Audio Feedback</td>
<td>10</td>
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<td>Sound Quality Needs Improvement</td>
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<td>Good Sound Quality</td>
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<td></td>
<td>Clarity of Feedback</td>
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<td>Using Audio Feedback Is a Welcome Change</td>
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<td></td>
<td>Uniqueness of Audio Feedback</td>
<td>3</td>
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<tr>
<td>3 Student-Teacher Connection</td>
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<td>2</td>
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<tr>
<td>4 Students’ Emotional Engagement</td>
<td>Meaningfulness of Audio Feedback</td>
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<td></td>
<td>Audio Feedback Considered Pleasant</td>
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<td>5 Perceptions of Learning Process</td>
<td>Audio Feedback Requires Concentration</td>
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<td></td>
<td>Audio Feedback Promotes Learning</td>
<td>14</td>
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<td></td>
<td>Prefer Responding through Text</td>
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<tr>
<td></td>
<td>Prefer Responding through Audio</td>
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<td></td>
<td>Prefer Gaining Combined Feedback Through Audio and Text</td>
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<td></td>
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<td>8</td>
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<tr>
<td></td>
<td>Prefer Gaining Feedback Through Text</td>
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<td>6 Suggestions for Course Re-Design</td>
<td>Development Suggestion</td>
<td>20</td>
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<tr>
<td></td>
<td>Positive Feedback from Pilot</td>
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</table>
supported their learning. When asked if students would prefer gaining feedback through text or audio, most of them responded that they would actually like to have both, as both mediums have their strengths. Audio feedback was nevertheless welcomed, as there were also those who clearly preferred using just audio or considered either audio or text as appropriate ways to receive feedback.

Or should these [audio and text] be used together? We would prefer audio, but add a very short written list of things to be corrected, as a title. (Group 1)

It does not matter to me. They both work, but I don’t see any reason for combined use. (Group 10)

We also queried if students would like to respond to the feedback through an audio file, but the majority prefer responding by text also in the future.

In their audio feedback, the two instructors provided student groups altogether 74 suggestions for improvement. Most of the suggestions \( (n = 52) \) targeted students’ understanding and application of learning theoretical perspectives to the case at hand. Instructor feedback varied from suggesting that students correct their misunderstandings to suggesting that they clarify or provide more evidence for some of their arguments, eg:

In terms of the contextuality [of learning], I think there’s a slight misunderstanding in your analysis, so please check what contextuality actually means in the meaningful learning framework, and whether it is realized in this [learning] environment. (Author 1, group 1)

For example regarding emotions you could elaborate, how does the implementation of this course in Moodle consider the emotional support for students, or does it? Are there elements in Moodle that you see promoting safety or joy of learning? (Author 2, group 6)

Some instructor suggestions \( (n = 14) \) were aimed at helping student groups use appropriate scientific references and cite them correctly, eg:

I encourage you to be critical and precise when using reference material. As you are assessing a university level MOOC [massive open online course], is a PhD thesis on primary school teaching or discourses related to renewing primary school education relevant to support your reflection? […] I could not find all the references you used in the list of references. (Author 2, group 7)

Finally, some instructor suggestions \( (n = 8) \) focused on how student groups described the case they had analyzed. The instructors were asking for more detailed information about the case and how students had gathered the information regarding their case.

In terms of the effectiveness of the instructor feedback, 13 out of 17 student groups reported in the questionnaire that the feedback was useful for improving their collaborative assignment and for learning. For example, students explained their experiences in the following way:

Audio feedback spurred new viewpoints with which to analyze our case, even though the feedback didn’t provide all the answers. (Group 3)

We were perhaps able to get a clearer picture of what we had succeeded in and what we needed to improve and develop. In terms of learning, too, the feedback was important. [The course was] not just about completing the assignment, submitting it, and that’s it. (Group 12)

The effectiveness of the audio feedback was also assessed by analyzing how many successful revisions student groups actually made based on the suggestions they received from their instructors (Table 2).

The analysis of student groups’ \( (n = 17) \) written documents and their revised case analyses indicated, first, that students reacted to all of the suggestions that they received from their instructors. Second, most of the revisions made by students (70.3%) were assessed as successful and adequate by the two instructors.
Discussion

As the authors of this paper worked as instructors on the course, as well as the researchers of the study connected to it, the practical and theoretical levels of development were intertwined. This is in line with the core idea of DBR (the Design-Based Research Collective, 2003). Our students provided us with their lived experiences of receiving and responding to audio feedback during a case-based online course.

This Finnish inter-university online course suggests that novel formative audio feedback practice, which was inspired by and followed the peer-review practices employed by scientific journals, was promising in promoting the emotional engagement of students and personal connectivity between students and instructors in a mobile learning setting. The study confirms earlier knowledge in that audio feedback was perceived personal (Dixon, 2015; Middleton, 2009; Parkes & Fletcher, 2014) and adds that this was experienced whether or not the students met with their instructor face-to-face (cf. Woodcock, 2016). Students’ emotional engagement and personal connectivity are development challenges for mobile HE (Crook et al., 2012; Dixon, 2015; Parkes & Fletcher, 2014; Ruokamo et al., 2012). Furthermore, the audio feedback proved effective in terms of the number of successful revisions that students made to their collaborative assignments, and also in terms of their self-reports of the meaning of the audio feedback for revising and for learning.

Both students’ experiences reflected in the analysis of the data and instructors’ experiences from the first course pilot enable summing up key implications to consider when re-designing the course. Clearly, the usability and quality of the audio feedback provided with the Vocaroo voice recording service were both considered as adequate by majority of student groups. The use of audio feedback supported the mobile course design as it promoted providing well-timed feedback for students whenever and wherever they needed it during their learning process (Crompton, 2013).

The majority of students welcomed the audio feedback or the integrated use of text and audio, but a few students preferred text to audio (see also Dixon, 2015; Mayhem, 2016; Nortcliffe & Midleton, 2007; Parkes & Fletcher, 2014). Therefore, in future implementations, the audio and written feedback will be integrated. Two student groups wished also for more detailed instructions on how to improve the assignment, while one group hoped for more positive feedback. The need to provide more positive feedback is acknowledged, but as for the more detailed instructions, the aim of the feedback is not to provide all the answers. To better facilitate students’ self-regulation, students will also be provided an opportunity to identify the strengths and weaknesses in their own work in relation to the assessment criteria of the course when handing their reports in for feedback. Presumably this will also help instructors to provide better focused feedback which can promote its’ meaningfulness even further (Nicol & Macfarlane-Dick, 2006).

<table>
<thead>
<tr>
<th>Coded categories of suggestions and revisions</th>
<th>Understanding and application of learning theoretical perspectives (N)</th>
<th>Description of the case (N)</th>
<th>Citing of references (N)</th>
<th>Total (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructors’ Suggestions for Improvement</td>
<td>52</td>
<td>8</td>
<td>14</td>
<td>74</td>
</tr>
<tr>
<td>Students’ Successful Revisions</td>
<td>41</td>
<td>6</td>
<td>12</td>
<td>59</td>
</tr>
</tbody>
</table>

Table 2: Instructors’ suggestions for improvement and consequent students’ revisions
Contrary to Nortcliffe and Middleton (2007), the use of audio feedback meant extra work for instructors, but it is anticipated that the workload will lessen in future implementations (see also Woodcock, 2016). The journal-style document where students reported their revisions is nevertheless considered meaningful as it made students’ learning process more visible and instructors potentially have an impact on it during the course. Audio feedback was perceived personal also by instructors and it was considered a good idea to deliver the links to audio files individually to each group instead of sharing them with all groups enrolled to the course in Moodle.

Although the close involvement with teaching and researching can be perceived as a strength of such DBR, the closeness can also be viewed as potentially compromising the validity of the research. The context and instructors’ engagement at the university they work at inevitably influences the theoretical underpinnings on which the practices will be built and the analysis that will be conducted after the data have been collected. However, DBR works with, through and alongside the contexts, which are never neutral or without agency. Researchers are expected to intervene (Anderson & Shattuck, 2012). DBR has been criticized for having an impact mostly on the local level, and not having sufficient power to produce large-scale and far-reaching structural changes in educational systems (Anderson & Shattuck, 2012). The challenge for researchers is to develop such theories that can be applied to new, local contexts and yet remain useful. The context of this research was specific in several ways, eg, in that the course participants were predominantly female.

The pedagogical feedback practices presented here are introduced in staff trainings locally and to wider scientific community to be reviewed and used elsewhere. Hence, the implications can spread further and not remain only at the local level. Even though this teaching experiment was conducted in a mobile learning setting, the study will contribute to transforming learning by designing audio feedback practices that empower students and their learning processes no matter how they are orchestrated.

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Statements on open data, ethics data and conflicts of interest
Research data gathered during this research can be accessed via ResearchGate (https://www.researchgate.net/).

Research data were gathered through a questionnaire to the course students, transcribed audio feedback provided for the students, and students’ performance results. For all of these we requested students’ informed consent. We informed the students as to the nature and aims of the research, and that their participation in the study was voluntary, and that they were free to withdraw from the research at any time. Research data were anonymized prior to analysis and storage. No approval was required from the institution ethics committee.

The authors have no conflicts of interest to declare in relation to this work.

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