Distance Collaboration with mobile technology – a practical report

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Introduction

The Covid-19 pandemic has forced our students to work from home. However, the students have to continue their university studies. We know, for example, that collaborative learning in mathematics is a central factor for student success.

The CEE/Innovation fund is funding a project on Mobile Learning, which started before the pandemic. Faced with the new situation of lockdown, we decided to explore whether mobile learning could help students to collaborate over distance, this way maintaining students' communication and collaborative learning activities, despite the lockdown. Hence, in order to maintain student success, we investigated two settings of facilitating student collaboration over distance (in the following called Distance Collaboration):

1. Applied Mathematics (AM): Students used Tablets & Smartpens to collaborate on a mathematical proof, while being at different locations on campus.
2. Biomedical Engineering (BMT): Students used tablets to work in the lab: One student did the actual lab work, while the peers can observe the lab work using MS Teams. This way, the group can communicate and exchange ideas during lab work.

Tools to facilitate distance collaboration with mobile technology

In the literature there are examples of tools that, when used in an integrated way, present almost unlimited opportunities to facilitate distance collaboration among students (Den Exter, Rowe, Boyd, and Lloyd, 2012). Aspects that influence the successful use of these tools are: teachers guidance, clear instructions and the match of the learning goals with the tool.

For the purpose of this study, we used a variety of tools to enable Distance Collaboration.

- **Web conferencing tools**: Zoom was used with Applied Mathematics (AM) students. MS Teams was used with Biomedical Engineering (BMT) students.
- **Tablet:** Apple iPad tablets were used with students from all three departments.
- **Smart Pen:** students from AM and AP were offered the opportunity to use Apple Pencils.
- **Online whiteboard:** students from AM were given the opportunity to collaborate on a shared PDF-file, where students could add their notes, ideas and drawings on white spaces.
- **Keyboard:** Apple smart keyboards were provided to the AM students, as a further means of proof writing.

Set up of Distance Collaboration with mobile technology

We ran two different settings of Distance Collaboration to accommodate the needs of the different assignments. For AM students, we simulated the Distance Collaboration setting by asking students to collaborate from different study rooms. For BMT, we supported Distance Collaboration between students in the lab and students from home.

The participants in Applied Mathematics were asked to complete an assignment defined by their respective lecturers in a Distance Collaboration setting, in pairs. The collaborative sessions ran for 60 to 90 minutes.

Regarding the BMT scenario, we supported BMT students in the forced Distance Collaboration setting (as a result of the safety COVID-19 restrictions). The students were given tablets to be used in the laboratory to facilitate communication with their peers from home. This way they could show the ongoing experiments and their work to students at home. The sessions (2 for each group) lasted for nearly 4 hours, we recorded the sessions of 3 groups, for a total of 23 students.

User Experience Questionnaires

After the students' DC sessions, we asked the students to fill in a User Experience (UX) questionnaire about their experiences with the DC setting. Early results are reported below.

The main finding from this early analysis is that all the students felt at ease with the respective Distance Collaboration settings. Accordingly, our current assumption is that Distance Collaboration does not particularly hinder the students' learning processes.

In particular, AM students found that a tablet with a smart pen had a positive impact in being able to communicate with their teammates through drawings and sketches, and to convey their ideas. The students remarked that drawing with a pen does require some practice. However, it seems that there was a systematic error where lines drawn with the smart pen where misaligned by a few millimeters.

One of the constraints of the AM students' set up was that the editable PDF file did not provide enough space to write on, as only one page at one time can be used. On the other hand, being constrained forced students to revise their drawings more often, which could support learning. Also, the writing function within the PDF had some draw backs such as not being able to edit writings from the other person, and not being able to understand the intention of the others' writings/drawings. The overall positive responses regarded the use of the smart pen:

> "The pen helped me draw sketches/annotate better using the pen more closely resembles the traditional pen and paper which is nice."

The BMT students were mostly satisfied with the Distance Collaboration set-up. The set up enabled those students that could not join the laboratory experiments in person to follow the lab work through MS teams. Some issues were reported by BMT students working in the laboratory, such as background noise and not being able to type on the tablet while performing the experiments. A student suggested:

> "In my opinion, Teams was easy to use. Of course, I would rather have the rest of the group at the same place, but I thought that Teams was a good solution. The settings of the iPad-Teams was also pretty easy to use."

Conclusions and Recommendations

The Students appreciated the benefits of Distance Collaboration. All the students found that the web conferencing tools used in this study (Teams and Zoom) were easy to use and helped in keeping connected, exchanging ideas and shorten distances.

As for the experience of BMT students in the skill lab, the Distance Collaboration setup used can easily be employed on a wider scale, as students could use their personal phones mounted on tripods as a means to communicate via MS teams. This would still realize the main goal of enabling students from home to see the execution of the experiment and to allow students to communicate with each other during lab work.

The tools used in the study are one option to realize Distance Collaboration. In principle, modern hybrid devices (2-in-1 Laptops) offer the same or similar functionality, including smart pen functionality.

Alternatively, it may be that input devices (pens) connected to graphic and drawing tablets (e.g. Wacom One, XP-Pen, etc.) can achieve a similar functionality for proof writing. As for the online whiteboard, there are many possibilities that allow students to share an editable document using a smart pen, where Miro and a shareable PDF are a few examples.

However, there are many aspects that need to be considered when using new tools in an online learning environment. Providing hardware that can facilitate connectivity needs to be supported by an effort to create an online environment that feels harmless. Lecturers and students need to be supported in creating a safe, engaging, and collaborative environment in line with the three above-mentioned aspects of successful use of Distance Collaboration tools.

References

Den Exter, K.; Rowe, S.; Boyd, W.; Lloyd, D. (2012). Using Web 2.0 Technologies for Collaborative Learning in Distance Education—Case Studies from an Australian University. Future Internet, 4, 216-237.