

A Digital Tabletop Tool for Teacher-Student Supervision to Support Student Learning

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Abstract - Effective integration of technology into teaching and learning is becoming an essential competency for teachers. General classroom lectures are important for understanding the course material, but providing other opportunities like well-structured individual or group supervision sessions for students is indispensable. This will ensure the full mastery of the subject matter and expand the scope of learning experiences. Following a pilot demonstration of 15 students and 3 supervisors, interviews were conducted and the feedback showed the benefits of group supervision for these students. Students noted many positive benefits in support of a collaborative learning environment using a digital platform, while supervisors followed suit in the same perspective. This article, therefore, describes the use of a digital tabletop board as a learning platform to facilitate individual/group supervision of students. After establishing the design requirements, we proceeded with prototyping, providing a series of sketches illustrating how users might progress through a task using the product under development and, lastly, the finished product with two major functionalities: notes taking and recording during a supervision session. The prototype was tested and analysed. The users indicated that the recording would help playback the supervision session. Also, in terms of usability, the interface was perceived as not different from that of the desktop paradigm, hence, user-friendly. Also, in terms of usability, the interface was perceived as not different from that of the desktop paradigm, hence, user-friendly. Teachers, on the other hand, noted the website created will provide notes or audio record for the students and even serves as announcement platform from the supervisors to the students on the class schedule. This would facilitate the achievement of course objectives and would enhance learning.

Keywords – Digital tabletop; teachers; students; cooperation; CSCW; CSCL.

I. INTRODUCTION

The quality of education is a major concern of all educational goals. Continuous support for students in individual or group supervision sessions has been defined as one of the most effective ways to improve and sustain the quality of learning [1].

Fixed-time schedule classes may not be effective enough for students to understand the whole lectures. However, other means can be employed to tackle this issue; for instance, organizing individual or group sessions with the help of a guidance counselor or an instructor. The supervision can take place in a convenient environment, be it inside the classroom, library, maker space, or the lab.

Individual or group supervision sessions between a teacher and students served to expand the scope of learning experiences, providing several unique opportunities for mentoring that are not available during general classroom lectures. Supervision, according to Ogunsaju [12], is a way of stimulating, guiding, improving, refreshing, encouraging and overseeing certain groups by supporting them in their learning process. It is a dual relationship, in which both students and teachers should engage. However, if the student and teacher do not engage in a cooperative way, the supervision benefits would diminish. Thus, the learning process will be undermined and both the teacher and the students will waste their time [2].

With the rapid development of emerging technologies, the integration of digital learning platforms has an influence on improving learning experience. However, during supervision sessions, paper notebooks methods are usually part of the process, and most of the communication is handled verbally. Thus, in this paper, we explored the need for a technology that can support cooperation in supervision sessions among teachers and students and, consequently, increase the learning possibilities of students. We designed a digital solution and tested it. The respective findings are presented in this paper. The paper is a work in progress and more research will be done looking into cooperation and technology in this individual encounter among students and teachers and how to prompt learning and reduce waste of time.

The rest of the paper is structured as follows. In Section II, we describe the background of the study. In Section III, we present the design process from data gathering to designing the prototype. In Section IV, we present the evaluation of the prototype and findings from participants or potential users on the importance of the device during their supervision sessions. Finally, we conclude in Section V which links the major findings with the relevant literature of the study.

II. BACKGROUND

Students find it challenging to commit to verbal information discussed with the teacher. The theory of constructivism believes learners construct knowledge individually or in groups based on prior experience or repetition of new information. Also, knowledge is the outcome of collaborative construction in a socio-cultural context mediated by discourse. Learning is fostered through

interactive processes of information sharing, negotiation, and discussion [4]. This theory acknowledges individual differences and believes students can construct knowledge through various learning resources and activities. Still, this theory acknowledges collaborative learning with which students can learn from each other as well as construct correct and meaningful knowledge. In addition, teachers remain facilitators in a constructivist learning environment [5], hence, playing an important part in the construction of knowledge together with the students. Instead of a paternalistic perspective, where the teacher leads and the student executes, in this paper, we discuss for more balanced power relations, especially during supervision sessions as individual time among students and teachers, being these individual students or students working together in a group project. This perspective has been discussed in Computer Supported Cooperative Work (CSCW) and Computer Supported Cooperative Learning (CSCL) [9].

Literature relating to class size is also important for this study; a lecture is usually a large class containing approximately 25-100 students at any time. During lectures, learning is instructor-directed, questions may be encouraged, but discussions are kept minimal [6]. Therefore, the large size and the physical distance between instructor and students could pose a challenge towards the formation of a healthy teacher-student relationship. It is safe to conclude that students learn very well and feel more positive in smaller classrooms than large lecture halls. The notion of supervision sessions in this regard cannot be overemphasized because it further enhanced learning [7].

There has been a lot of activity in creating tools that utilize learning analytics, with a focus on educational technology [8].

The collaborative approach to education has been shown to develop critical thinking, deepen the level of understanding, and increase shared understanding of the course material [10]. CSCL facilitates collaboration by using computer-mediated communication tools to enable new communication methods between teachers and students. However, the nature of CSCL has to be taken into account from the first planning stages when designing the model because it can be a drawback instead of a benefit. While there has been extensive research on the benefits and drawbacks of collaborative learning approaches in higher education [11], there has been less research on how the choice of collaborative tools affects cooperative processes and collaborative outcomes. This paper aimed at designing a digital learning platform that students will find easy to work with and that will further enhance learning.

III. DESIGN PROCESS

In this paper, we explore how to facilitate learning in supervision sessions through the help of technology. Thus, we took an interaction design process approach to explore the needs of students and teachers in supervision and then

designed a digital tool that could support and increase the learning potential of such sessions. We describe the interaction design process below.

A. Informing phase

As a primary source of data collection, we conducted interviews with 15 undergraduate students and 3 professors based on the challenges faced during a supervision session.

For the students, the interview aim was to find out how often do they take supervision from their teachers, whether they use technology during supervision sessions, and if supervision is really important to them.

For the professors, the aim was to find out how often do they supervise students and what spaces do they use, do they keep track of progress on each student's work during supervision, what could be improved from their past experience on technological perspective and, lastly, how do they like to share the lesson of supervision session with the student that could not attend the supervision session. A consent form was signed from all the participants in the study.

We found that students prefer to have more cooperative supervision sessions that can integrate technology. The need for technology should support easy access to lecture materials. On the other hand, teachers want to improve their supervision experience by replacing the old method of chalk, talk, and paper experience with new technology. They also stated that they embrace the notion of recording the supervision session as a means for facilitating students to remember by referring back to it.

B. Design

Based on the findings, we decided to design a tabletop solution that could be used during supervision.

The top of the table would be an interactive screen in which an application that can be used during supervision could be started. The application we designed had the following functionalities:

1. A pen-based touch board where both the supervisor and the students could write notes or make sketches about things that are discussed during supervision. This functionality would help to improve the current situation of paper and chalk and, at the same time, afford a more sustainable way of having these notes in a common space, which will be later saved in the students and teacher folder (Figure 1).
2. Another important functionality is the recording button which, if pressed, will record the sessions. This is helpful in the situation when the students forget about the verbal information, and maybe they might not understand at the moment and want to come back to it. By repetition of the recordings, the student will have a higher chance of processing and internalizing the information (Figure 1).

3. Saving the notes on the cloud on specific folders for the students will improve the situations when papers are lost, and sometimes students do not have access to them (Figure 2).

The idea of a tabletop interface was inspired by the setting where supervision happens, namely, in a room where all the students are sitting around the table together with the teacher. Moreover, the tabletop metaphor which covers the whole table area serves as a mean for expanding the collaboration space among the student and the teacher. While making schemas and writing on a piece of paper is more or less a personal activity which can be shared with others, in the case of a tabletop, this surface is expanded. This helps in making the students and teachers more equal during supervision and can motivate cooperation.

C. Prototype

The prototype for the app was developed in ADOBE XD and testing was done through the Wizard of Oz technique.

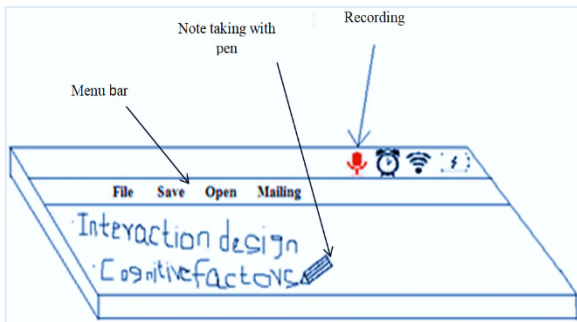


Figure 1. Interface for Note-taking and recording.

Figure 1 shows where both the supervisor and the students could write notes, record, or make sketches about things that are discussed during supervision.



Figure 2. Saving files /File locations.

Figure 2 indicates the process of saving the notes in specific folders either on the device hard disk, cloud (internet) or Tabletop (Website) during or after supervision.

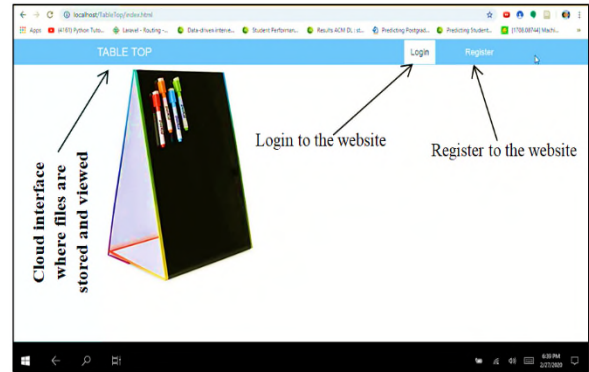


Figure 3. Accessing files on Tabletop (Website).

Figure 3 indicates that, for students to have access to the websites (Tabletop), they must log in with their username and password.

D. Evaluation

A number of tests were conducted with a few students and teachers to evaluate usability, accessibility, cooperation, and learning enhancement.

We conducted observations in two supervision sessions of one lecturer's office with 2 students at one time and one student another time. We initially installed the prototype on the lecturer's office tabletop. The users were briefed on the basic functionalities of the prototype prior to usage. For testing, we used the Wizard of Oz technique by installing a projector that projected the application on the tabletop, while one of the team members faked the touch-based interaction with the tabletop. The idea of testing was not to look into details of the solution, but focus on the user experience and the set of functionalities that we had integrated. The two sessions were video recorded, and handwritten notes from the first author were taken on site. Moreover, after the supervision, we interviewed in-situ the teacher and the students regarding their experience with the prototype in terms of cooperation during supervision. The video recordings, the notes, and interview answers were then analyzed to make sense of the user experience. The analysis is in its initial phases, and the findings presented below are based on the answers of the users regarding their experience with the prototype.

IV. FINDINGS

From the evaluation, we received a lot of feedback.

1) *Students* - appreciated the recording functionality by stating that, if you are not taking down notes, you can just launch the audio recording to avoid being lost in the course of the discussion. Furthermore, the information on the cloud will help students who could not make it for the supervision.

2) *Lecturer* –indicated that it would be beneficial to have the possibility to post assignments in this group space and make it work as a social platform for communication

with regards to announcements concerning supervision schedule. In addition, the lecturer was asked to rate the digital tabletop with regards to learning enhancement and indicated that it serves as a collaborative platform whereby students play an active role instead of being passive.

Generally, students currently find it challenging to manage information either from the classroom lectures or in an individual or group session. Conceptualizing and designing a digital tabletop with the functionalities of note-taking and recording can help enhance learning and collaboration.

V. DISCUSSION

The paper described how a digital tool was designed to enhance cooperation in supervision sessions.

In conceptualizing the design space, an instructing interaction type was used in this prototype, where users issue instructions to the system. This can be done in several ways, including typing in commands or selecting options from menus in a windows environment. Literature indicates that knowledge is constructed through prior experience or repetitive studying of recorded materials and also when students gather as groups. Learning is fostered through interactive processes of information, negotiation and discussion.

Additionally, student and lecturer interaction is not only confined to lecture rooms where the large classroom size and the physical distance between lecturer and students could pose a challenge towards the formation of a healthy teacher-student relationship. Supervision sessions are often offered. This setting contributes to motivating the students and has an impact on learning.

A successful supervision session is the creation of a cooperative and transformative learning environment between the supervisor and the students. The supervisor should guide and facilitate the students, allowing them to create their own learning process as they move through the phases of collaborative activities [13]. Supervisors should give up some control, and students must take on more responsibility so as to establish and nurture a collaborative community of learners. This is where our prototype can contribute. It can enhance the supervision experience by increasing cooperation. Cooperation can further be the foundation for learning. Our solution was designed mostly as a proof of concept, and, through this paper, we want to

open up the discussion of technologies that can enhance cooperation in supervisions.

In the future, we will continue exploring different kinds of technological solutions that can support both cooperation and learning during supervision.

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