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Reflective Experiential Learning: Improving the Communication Skills of Software Engineers using Active Video Watching

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Abstract: Communication skills are an essential competence for software engineers. However, teaching communication skills in a customary educational setting is costly and time-consuming. This paper presents a PhD project, which focuses on adopting active video watching (AVW) for teaching Software Engineering students how to improve their communication in face-to-face meetings. The paper outlines the objectives and research methodology. An instrument to measure face-to-face meeting communication skills of Software Engineering students was developed and validated during the first phase of the study. In the second phase, we investigate the impact of an active video watching system on software engineering students' face-to-face meeting communication skills. In the last phase, this project will enhance the AVW platform by identifying and designing a teaching approach that scaffold interactive learning behaviours amongst students during active video watching and examine the efficacy of the method on software engineering students' face-to-face meeting communication skills.

Keywords: face-to-face meeting communication, active video watching, instrument validation.

1. Introduction

Communication skills are perceived as fundamental for Software Engineering (SE). Although communication proficiency is not the sole focus of the SE occupation, keeping in mind that the critical responsibility of software engineers includes interacting with different types of stakeholders, the significance of communication competence in the software development discipline is highly amplified (Werner et al., 2017). Hence, the ability to communicate effectively is crucial in the SE profession (Eggleston & Rabb, 2018). According to Almeida et al. (2019), face-to-face communication amongst software engineers happens quite often, and it is primarily related to team collaboration. In addition, the authors summarise that the oral communication abilities essential for the workplace are proficiency in face-to-face meeting interactions, dyadic interactions, interpersonal communication and negotiation.

Although the significance of face-to-face communication skills to SE activities are well evidenced in the literature, teaching these skills to university students is challenging as they demand extra efforts and resources (Anthony & Garner, 2016). Soft skills are usually taught in the context of a software development project course (Marques et al., 2018). Students need to learn how to rephrase under several situations, receive and reflect on feedback, to be able to retain and apply the skills in their future careers. Instructors struggle to provide this extra training effectively because of the already jam-packed and over-demanding curriculum (Harichandran et al., 2014).

Video-based education is particularly useful for teaching soft skills, where the process of learning requires contextual experience to retain knowledge (Cronin & Cronin, 1992; Mitrovic et al., 2017). While videos are very popular learning media, students tend to be passive while watching videos. In order to learn effectively from videos, students need to actively engage with the learning material (Chatti et al., 2016; Chi & Wylie, 2014). Numerous projects have coupled interactive features (such as quizzes and collaborative annotation) into video-based learning to improve student engagement (Chatti et al., 2016; Yousef et al., 2014). Even though these approaches increase student engagement, they demand extensive effort from educators during the production of video materials, and also require sophisticated learning platforms. Based on the findings and suggestions of previous studies, this

research project will expand the empirical discussion by examining the impact of Active Video Watching (AVW) on student learning engagement and the overall learning outcome.

The AVW-Space system was designed to investigate the efficacy of teaching soft skills with AVW technique (Mitrovic et al., 2017). This platform exploits students' familiarity with commenting on videos on social media platforms (such as YouTube and Facebook) and couples interactive notetaking during video watching to encourage student engagement with learning content (videos) and self-reflective learning. AVW-Space allows instructors to create a space by embedding YouTube videos directly into the platform. Previous studies have demonstrated the effectiveness of AVW-Space in teaching presentation skills (Mitrovic et al., 2019).

Therefore, this PhD project expands on the communication instruction approaches generally employed in SE programs to include AVW pedagogy as a novel approach to improve the face-to-face meeting communication performance of SE students.

2. Proposed Research Work

The first goal of the PhD project was to develop an instrument to measure face-to-face meeting communication skills of SE students. According to Huang & Lin (2018), there are numerous reasons why new measurement tools for communication skills are desirable in this modern age. Firstly, the authors argue that most existing communication assessments instruments are outdated, and since communication practices evolve with the change of time, more modern assessment tools are needed to assess communication skills in this new era of globalisation. Secondly, they highlight that little is known about the factor structure of the existing tools, so the validity and utility of these measures are questionable. Lastly, to quickly diagnose issues pertaining to communication competence of students, an assessment tool is desirable so that educators can pay specific attention to the exact aspect of students' communication competence that needs further attention (Huang & Lin, 2018). Thus, the first objective of this study is to develop an instrument to measure face-to-face meeting communication skills of SE students, and examine the internal consistency and reliability of the developed tool. This phase was guided by the following research questions:

RQ 1.1. What are the primary constructs of the instrument that can measure face-to-face meeting communication skills of SE students?

RQ 1.2. What is the content validity related evidence that the items developed are a valid measure of face-to-face meeting communication skills of students?

RQ 1.3. What are the internal consistency related evidence that the items developed are a reliable measure of face-to-face meeting communication skills of SE students?

RQ 1.4. What is the construct validity related evidence that the items developed are a valid measure of face-to-face meeting communication skills of SE students?

The second goal of this project is to investigate the effectiveness of using AVW-Space to teach face-to-face communication skills that SE students employ during meetings. This phase was guided by the following research question:

RQ 2. What are the learning outcomes of using AVW-Space to teach face-to-face meetings communication skills?

This project also aims to contribute to scholarship in the area of Technology-Enhanced Learning. We classify students based on their overt behaviour in AVW-Space using the ICAP framework (Chi & Wylie, 2014) into four learning modes: Interactive, Constructive, Active and Passive. Interactive learning mode requires dialogs between the student and peers or instructors, and is the most beneficial in terms of educational outcomes. The key idea is that interactivity needs to involve a substantial level of turn-taking to co-create a common understanding of the learning content. Interactivity is not currently supported in AVW-Space. Hence, in this project, we will extend AVW-Space to facilitate interactive learning. The following research questions will guide this phase:

RQ 3.1. To what extent does the proposed intervention scaffold interactive learning behaviours in AVW-Space?

RQ 3.2. To what extent does the proposed intervention improve the face-to-face meeting communication skills of SE students?

3. Pilot Study

The pilot study was conducted to address RQ1.1-RQ1.4. We used a deductive approach in the initial phase of scale development to produce research-informed theoretical definitions of face-to-face meeting communication skills. After several reviews of the preliminary scale, we chose 25 items measuring four themes based on the recommendations from discipline experts (software engineering practitioners) and collective agreement by the research group. A pilot study was conducted in August 2020 to evaluate the items and examine the factor structure and internal consistency of the developed scale.

The pilot study was conducted with 111 students SE courses, who were invited by email to complete a Qualtrics survey, which included demographic information, a group assignment scenario and the preliminary scale items. The participants were advised that the scale would measure their face-to-face meeting-related behaviours. The participants were asked to rate the level that describes their typical behaviour during a meeting with a series of statements using a 7-point Likert scale, ranging from 1 (never) to 7 (always). Since the objective of the pilot study was also to identify any issues with item clarity, participants were provided with a space for feedback on the scale items. The participants were instructed to discuss issues with any of the items and suggest alternative wording or structure for confusing or unclear items. All participants were informed that their responses would be confidential.

The preliminary findings of the pilot study identified two items that the participants had issues with clarity and comprehensibility. Therefore, these items were removed from the scale before the factor structure was analysed. For example, for the question "I do not refer to non-technical concepts that may confuse other meeting participants." participants' comments included: "*The question is ambiguous due to double negative and the term non-technical. Could not totally understand it, hence neutral.*" and "*I found the question more difficult to understand. I interpreted it as if I DO refer to tech concepts then this is Never and if I DONT then this is Always*". Also, there were some suggestions to rephrase this item "I listen to the other meeting participants, paying attention to her/his body language" and the question was reworded to "I pay attention to the other meeting participants body language". In total, 23 items remained following the pilot test and further data collection is needed for the next step of the evaluation.

4. Study One

Figure 1 shows an overview of Study 1, which focuses on RQ2. The study took place at the University of Canterbury in a SE project-based course with 56 students. The students worked in teams of 4 to 6 students, and had weekly face-to-face meetings to discuss the progress. The students were invited to participate in the study in July 20, 2020. We administered a profile survey consisting of three sections: demographic questions, prior conceptual knowledge, and the self-assessment instrument. After the completion of the survey, the participants watched and commented on ten short videos (2 to 6 minutes long) pertaining to effective communication skills for meeting participation on the AVW-Space platform. Six of these videos were tutorials on effective communication skills concepts; four videos were example of real meetings.

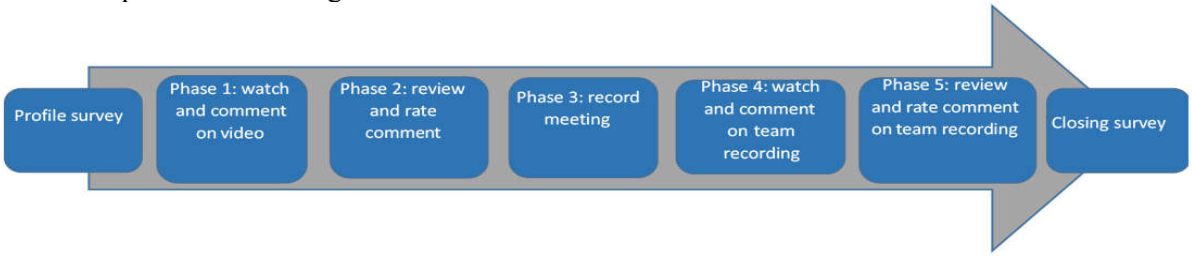

Figure 1. Overview of different tasks in Study 1.

Participants could stop a video at any time, enter a comment and select an aspect to indicate the intention of the comment (example of aspects "I am rather good at this", "I did/saw this in the past", "I didn't realise I wasn't doing this" and "I like this point"). For the example videos, the aspects correspond to effective communication skills covered in the tutorials, which include, "Verbal communication",

"Giving feedback", "Receiving feedback", "Active listening" and "Meeting contribution". In phase 2, the authors screened comments for content and select comments that were visible to all participants. Participants were instructed to review and rate the anonymised comments based on the specified categories (such as "I did not notice this", "I do not agree with this", "This is useful for me", "I like this point" and "I hadn't thought of this"). In the third phase, each team had their weekly meeting recorded and uploaded to AVW-Space. The members of each team then watched the recording of their meeting and commented on their own meeting, and later rated the comments written by their peers in the same team. At the end of these tasks, invitations to complete Survey 2 were emailed on August 20, and the survey was closed on August 27 2020. The preliminary results show that out of 56 students enrolled in the course, 49 completed Survey 1. Of those, 47 have used AVW-Space, while the remaining two participants were inactive learners.

5. Future Work

The future work will include analyzing data collected in Study 1, and then exploratory research to determine and develop an intervention to facilitate effective interactive learning in AVW-Space. We will extend AVW-Space to support interaction between students. Study 2 will contain one group of randomly selected students working with the new version of AVW-Space (experimental group), and another group of students working with the standard version of AVW-Space (control). The data will be quantitative and will be collected through the student logs of AVW-Space and pre- and post-questionnaires (the same ones used in Study 1).

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