The Effects of Quality of Technology on Learning Performance in Remote Lectures

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Abstract

After the events of the past few years, universities have continued to appreciate the concept of hybrid and most lectures are still accommodating remote participation. However, while the situation has improved from the early 2020, both students and lecturers are still facing numerous technology related issues, common complaints being the quality of audio, video and a general lack of understanding of the technology. In our research, we are examining these issues and identifying solutions in order to make recommendations to educational institutions on how to ensure that the quality of technology does not come in the way of students' learning performance.

Keywords

Remote Lectures, Online Learning, Learning Performance, Hybrid

1. Introduction

Since the beginning of 2020, education systems faced a challenging situation on how to conduct lectures during the Covid-19 lockdowns. Due to the urgent situation, schools and universities quickly implemented different remote lecture models. Overtime better practices, choices of technology and guidelines were developed in order to better meet the needs of the students and teachers alike. Despite the pandemic easing up recently, most universities are still embracing the option for hybrid learning. While the implementations for remote lectures have improved, there is still work to be done for ensuring that that the technology does not hinder the learning experience[1].

The purpose of our research is to identify the issues relating to the technology used in remote lectures and find solutions for improving the students' performance in these remote lecture settings. In this paper we aim at a better understanding on what issues students are facing regarding the quality of the technology such as audio and video quality and how it can affect students' performance. We conducted six semi-structured interviews with university students regarding their experiences with remote lectures, issues they have had in the past relating to the lecture technology and their views of the effects of quality of the technology. Based on

these findings, we can make suggestions to universities on how to ensure that the quality of the technology does not interfere with learning performance and also use this data for future research.

1.1. Related Work

There has been prior work related to how certain aspects of audio quality can have an effect on learning performance. A study by Marey et al. [2] researched how clarity and sentence recognition were positively affected by increasing the microphone quality and how the adjustments to the environment didn't have a significant effect. Several studies on Zoom have found out that the major reasons for dissatisfaction with Zoom were mechanical errors such as poor image quality, audio quality and freezing [3]. The effects of audio quality has also been studied in many different contexts and having an acceptable quality level seems to be crucial but going beyond that could have lesser effect [?].

2. Research Method

For this research, we conducted a qualitative interview study to establish a baseline for future investigations. We employed two selection criteria for interviewees: 1) current enrollment in higher education and 2) recent participation in remote lectures. The first criterion ensured that responses could be meaningfully compared, focusing on students in higher education. The second criterion aimed to capture current remote lecture experiences, acknowledging that early 2020 experiences might not reflect the current remote lecture environment.

We interviewed six university students about their experiences with remote lectures, using a convenience sampling approach. Their profiles are detailed in Table 1. Interviews followed a semi-structured format, with uniform questions and limited interviewer comments, aligning with Kallio (2016) [4]. Three interviewees held research assistant positions within our university unit and were familiar with the technical solutions used in some of our courses. Five interviewees studied information technology or information systems, and one had a background in Comparative Literature alongside prior information technology studies.

The interviews comprised three question sets: 1) questions on the interviewee's major, year, role in the university, and technology proficiency; 2) questions about remote lecture experiences; and 3) questions regarding technology quality and its impact on learning performance. The first set established baseline information and identified potential correlations with later responses [5]. The second set explored the technical aspects of remote lecture experiences and sought common themes or issues among interviewees' experiences. The last set of questions aimed to gauge students' views on how improved technology quality could impact the experiences outlined in the second set. We began this section by presenting an ideal scenario where audio, video, and presentation quality significantly improved. Regarding data analysis, we employed thematic analysis to identify recurring themes in the interview data [6]. In this concise paper, we report the emerging interview themes.

Table 1
Interviewee Profiles

ID	Major	Role	Year
ID1	Information Systems	Research Assistant	+10
ID2	Information Technology	Research Assistant	+10
ID3	Information Technology	Research Assistant	4
ID4	Information Systems	Student	3
ID5	Information Systems	Student	3
ID6	Comparative Literature	Student	6

3. Preliminary findings

Nine key findings emerged from the early phase of data analysis which we considered to have significance. The findings are presented in the Table 2. The third column signifies the percentage of the interviewees who agree with the finding reported in the second column.

Table 2
Findings from interview data.

ID	FINDING	%
F1	Low quality of audio can decrease performance	100%
F2	Importance of educating the lecturers regarding remote lectures	100%
F3	Not hearing audience questions and the question not being repeated	66,6%
F4	Lecturers not knowing how to use the technology	66,6%
F5	Described setup could increase interactivity and/or interest	66,6%
F6	Connection issues from the lecturer	66,6%
F7	Significantly higher quality might not have an effect on performance	50%
F8	Lecturer not noticing questions by remote participants on chat	50%
F9	Low quality of video can decrease performance	16,6%

From these nine findings, three were most significant; All interviewees agree that low quality of audio can decrease performance of the students. One interviewee (ID6) claimed: "*I think the audio part is the most important.*" They also all agree that it is important to educate lecturers on the use of technology and increase their awareness of the quality of audio/video and the its impact on the learning experience. In regards to the video quality, only one interviewee (ID6) had the sentiment that lower quality video feed can negatively affect the learning performance. Other interviewee (ID4) emphasizing the importance over audio over video: "*I think that video camera is not that important, it can be low quality, but audio flow should be really good because mic can eat up some sounds and then it can be really unclear what have been told.*"

4. Discussion

The purpose of this research is to gain an understanding what issues students are facing regarding remote lecture technology and their thoughts on how quality of this technology can affect performance. Based on the preliminary findings from the interviews, we have gained some indications that the level of quality can correlate with learning performance. In order

to ensure a successful learning experience, there is a certain level of quality that must be met, otherwise it can affect student's performance in the lecture. However increasing the quality past this level can have diminishing returns. Audio quality was deemed more important than video quality as many students do not necessarily follow the lecture visually at all. All interviewees describing experiencing issues regarding audio and mentioned the importance of educating the lecturers on lecture technology.

5. Conclusion and Future Work

In this paper, we found out what kind of issues students are still facing relating to the remote lecture technology and how they perceive the quality of the technology and its effects on learning performance. There is a certain level of quality that must be met in order to have an undisturbed learning experience but also that increasing the quality past that level can have diminishing returns. There should be more standardized equipment provided to the lecturer's and more education on practices relating to technology used in remote lectures.

We are continuing our research regarding the subject and we are conducting a survey study based on the data from this study. With this, we can have a better understanding on how certain aspects of quality can affect performance.

References

[1] L. Vyas, "New normal" at work in a post-COVID world: work–life balance and labor markets, Policy and Society 41 (2022) 155–167. URL: https://doi.org/10.1093/polsoc/puab011. doi:10.1093/polsoc/puab011.

[2] A. Marey, S. Goubran, K. Tarabieh, Refurbishing classrooms for hybrid learning: Balancing between infrastructure and technology improvements, Buildings 12 (2022) 738. doi:10.3390/buildings12060738.

[3] H. Kim, The efficacy of zoom technology as an educational tool for english reading comprehension achievement in efl classroom, The International Journal of Advanced Culture Technology 8 (2020) 198–205. URL: https://api.semanticscholar.org/CorpusID:233280258.

[4] H. Kallio, A.-M. Pietilä, M. Johnson, M. Kangasniemi, Systematic methodological review: developing a framework for a qualitative semi-structured interview guide, Journal of Advanced Nursing 72 (2016) 2954–2965. URL: https://onlinelibrary.wiley.com/doi/abs/10.1111/jan.13031. doi:https://doi.org/10.1111/jan.13031.

[5] W. Adams, Conducting Semi-Structured Interviews, 2015. doi:10.1002/9781119171386.ch19.

[6] M. Vaismoradi, H. Turunen, T. Bondas, Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study, Nursing health sciences 15 (2013). doi:10.1111/nhs.12048.