

Impact of Digital Learning Platforms on Senior High School Students' Engagement in the Philippines

Ronald Paul B. Macario¹, Jayson R. Tabian², Jesus Paguigan³

College of Education, Eulogio “Amang” Rodriguez Institute of Science and Technology

Abstract

The rapid shift to digital learning platforms in Philippine education, intensified by the COVID-19 pandemic, has reshaped senior high school (SHS) instruction. This study investigates how these platforms influence behavioral, emotional, and cognitive engagement among SHS students and identifies platform features that best predict engagement and learning outcomes. Using a descriptive-correlational design, the study involved 350 Grade 12 students selected through stratified random sampling across multiple campuses. Data were gathered using validated instruments measuring platform effectiveness, engagement dimensions, and digital literacy. Results show that students demonstrated high engagement in digital platforms ($M = 4.2$, $SD = 0.65$). Cognitive engagement emerged as the strongest predictor of digital literacy ($\beta = 0.42$, $p < 0.001$), while instructional quality and interactive features were significant predictors of overall engagement ($R^2 = 0.314$). Learning self-efficacy was strongly correlated with engagement ($r = 0.69$, $p < 0.001$). Despite these positive outcomes, videoconferencing fatigue affected 68% of respondents and remained a major barrier. Overall, digital learning platforms positively influence SHS student engagement when supported by strong instructional design, interactive tools, and teacher techno-pedagogical competence. The study recommends balancing synchronous and asynchronous activities, enhancing teacher digital skills, and addressing inequities in device access and security.

Keywords: digital learning platforms, student engagement, senior high school, Philippines, learning management systems, online learning, educational technology

I. INTRODUCTION

The rapid advancement of technology and the widespread adoption of digital learning platforms have significantly reshaped the educational landscape in the Philippines, especially at the senior high school (SHS) level. The shift toward online and blended learning environments, intensified by the COVID-19 pandemic, has introduced new modes of instruction that rely heavily on interactive platforms, virtual classrooms, and digital resources. As schools continue to integrate these tools into regular teaching practices, understanding how digital platforms influence student engagement has become essential. Engagement—encompassing behavioral, emotional, and cognitive dimensions—is a key determinant of learning success and overall academic performance. However, despite the increasing reliance on digital tools, there remains limited empirical evidence on how these platforms specifically affect engagement among Filipino SHS learners. This study addresses this gap by examining the impact of digital learning platforms on student engagement and identifying the platform features that contribute to or hinder active

participation and meaningful learning experiences.

A. Background of the Study

The Philippine education system has undergone a profound digital transformation, particularly in senior high school (SHS) education, where learning management systems (LMS), synchronous videoconferencing platforms, and educational applications have become integral to instructional delivery [1]. This shift, accelerated by the COVID-19 pandemic, represents a fundamental change in how Filipino adolescents access education and engage with learning materials [2]. Senior high school students, typically aged 16-18 years, constitute a critical population in this transition, as they navigate complex academic demands while preparing for higher education or employment.

Digital learning platforms encompass a range of technologies including learning management systems (e.g., Google Classroom, Moodle, Canvas), synchronous communication tools (e.g., Zoom, Microsoft Teams, Google Meet), and specialized educational applications designed for both online and offline use [3]. These platforms facilitate content delivery, student-teacher interaction, collaborative learning activities, and assessment in ways that differ fundamentally from traditional face-to-face instruction [4]. The Philippine context presents unique challenges and opportunities for digital learning implementation. While urban areas have seen rapid adoption of educational technologies, disparities in internet connectivity, device availability, and digital literacy persist across regions and socioeconomic groups [5]. The Department of Education's adoption of various distance learning modalities—including online, modular, and blended approaches—has made understanding platform effectiveness and student engagement a national priority

B. Objectives of the Study

This study aims to:

1. Describe usage patterns and perceived effectiveness of learning management systems, synchronous platforms, and educational applications among senior high school students in the Philippines.
2. Measure and compare levels of behavioral, emotional, and cognitive engagement in digital learning environments across different student demographic groups.
3. Identify platform features and teacher competencies that significantly predict each dimension of student engagement.
4. Examine the mediating role of engagement dimensions in the relationship between platform features and learning outcomes (digital literacy and academic performance).
5. Document challenges and barriers that affect student engagement in digital learning contexts, including technological, pedagogical, and socio-emotional factors.

II. METHODS

This study employed a descriptive-correlational research design to examine the relationships among digital learning platform features, teacher techno-pedagogical skills, student engagement dimensions, and learning outcomes. This design is appropriate for identifying associations among variables and predicting outcomes without experimental manipulation. The correlational approach allows examination of naturally occurring relationships in authentic educational settings, providing ecological validity while enabling statistical prediction modeling

Population and Sampling Frame

The target population consisted of Grade 12 senior high school students enrolled in institutions using

digital learning platforms in the Philippines during the 2022-2023 academic year. Grade 12 students were selected because they have accumulated experience with digital platforms throughout their SHS education and can provide informed assessments of platform effectiveness and engagement.

Sampling Method

Stratified random sampling with proportional allocation was employed to ensure representation across key demographic variables [1]. The sampling frame was stratified by:

- Academic strand: STEM (Science, Technology, Engineering, Mathematics), HUMSS (Humanities and Social Sciences), ABM (Accountancy, Business, and Management), TVL (Technical-Vocational-Livelihood)
- School type: Public and private institutions
- Geographic region: Representation from Luzon, Visayas, and Mindanao
- Urban/rural classification

Within each stratum, students were randomly selected using random number generation. This approach ensures that the sample reflects the diversity of the SHS population while maintaining statistical rigor.

Sample Size Determination

The target sample size was set at $n = 350$ based on power analysis and precedent from similar Philippine studies [1]. This sample size provides:

- Statistical power of 0.80 to detect medium effect sizes ($f^2 = 0.15$) in multiple regression analyses with $\alpha = 0.05$
- Adequate representation across strata (minimum 30 participants per stratum)
- Sufficient cases for subgroup analyses by demographic variables
- Buffer for potential incomplete responses (anticipated response rate: 90%)

Inclusion and Exclusion Criteria

Inclusion criteria:

- Currently enrolled as Grade 12 student in participating institution
- Active use of digital learning platforms for at least one semester
- Voluntary consent to participate (with parental consent for minors)
- Access to internet-enabled device for survey completion

Exclusion criteria:

- Students who have been absent from digital learning for extended periods (>4 weeks)
- Incomplete survey responses (>20% missing data)

III. RESULTS

Participant Characteristics

A total of 350 Grade 12 students from 12 senior high schools across the Philippines participated in the study. Table 1 presents the demographic profile of participants.

The sample achieved good representation across strata, with slight overrepresentation of female students (58.6%) reflecting typical gender distributions in Philippine SHS education. STEM students comprised the largest strand group (36.6%), followed by HUMSS (29.1%). The urban-rural split (66.0% urban,

34.0% rural) approximates national SHS enrollment patterns. Notably, 35.4% of students relied solely on smartphones for digital learning, highlighting device access challenges.

Digital Learning Platform Usage Patterns

Platform Types and Frequency

Google Classroom emerged as the dominant LMS (89.1% of students), with most using it daily (76.3%). Synchronous platforms showed high adoption, with Zoom (82.0%) and Google Meet (76.6%) used frequently but less intensively than LMS platforms. Educational apps supplemented core platforms, with Quizlet being the most popular (44.6%).

Time Spent on Platforms

Students reported spending an average of 5.8 hours per day ($SD = 2.1$) on digital learning platforms during school days:

- LMS activities: $M = 2.4$ hours ($SD = 1.1$)
- Synchronous sessions: $M = 2.7$ hours ($SD = 1.3$)
- Educational apps: $M = 0.7$ hours ($SD = 0.6$)

Rural students spent significantly less time on platforms ($M = 4.9$ hours, $SD = 2.3$) compared to urban students ($M = 6.2$ hours, $SD = 1.9$), $t(348) = 5.12$, $p < 0.001$, $d = 0.59$, likely reflecting connectivity constraints.

Perceived Effectiveness of Digital Learning Platforms

Students rated all platform effectiveness dimensions at high levels ($M > 3.98$). Instruction Quality received the highest ratings ($M = 4.21$, $SD = 0.61$), suggesting that teachers successfully adapted instructional practices for digital delivery. Interaction Quality scored lowest ($M = 3.98$, $SD = 0.71$), indicating room for improvement in facilitating student-student and student-teacher interactions online. Teacher techno-pedagogical skills were rated highly ($M = 4.18$, $SD = 0.64$), reflecting positive perceptions of teacher digital competence.

Student Engagement Levels

Overall and Dimensional Engagement

Overall student engagement was high ($M = 4.02$, $SD = 0.65$), indicating that SHS students in the sample were actively engaged with digital learning platforms. Behavioral engagement was highest ($M = 4.15$, $SD = 0.69$), reflecting strong participation in observable learning activities. Emotional engagement was relatively lower ($M = 3.87$, $SD = 0.78$), suggesting that while students participated actively, their affective connection to digital learning was less robust. Cognitive engagement was substantial ($M = 4.05$, $SD = 0.71$), indicating meaningful use of learning strategies and deep processing.

Engagement Distribution

Figure 1 illustrates the distribution of students across engagement levels.

- Very High Engagement ($M \geq 4.5$): 28.3% ($n = 99$)
- High Engagement ($3.5 \leq M < 4.5$): 54.6% ($n = 191$)
- Moderate Engagement ($2.5 \leq M < 3.5$): 15.1% ($n = 53$)
- Low Engagement ($M < 2.5$): 2.0% ($n = 7$)

The majority of students (82.9%) demonstrated high or very high engagement, while only 2.0% showed low engagement. This distribution indicates generally successful engagement with digital platforms in the sample.

Correlational Analyses

Relationships Among Platform Features and Engagement

Key findings from correlational analyses:

1. Strong inter-correlations among platform features ($r = 0.57$ to 0.72), suggesting that high-quality platforms tend to excel across multiple dimensions.
2. Teacher techno-pedagogical skills correlated strongly with all platform features ($r = 0.63$ to 0.71) and all engagement dimensions ($r = 0.56$ to 0.62), confirming the critical role of teacher competence.
3. Interaction Quality showed the strongest correlation with behavioral ($r = 0.62$, $p < 0.001$) and emotional engagement ($r = 0.59$, $p < 0.001$), highlighting the importance of interactive features.
4. Instruction Quality correlated most strongly with cognitive engagement ($r = 0.61$, $p < 0.001$), suggesting that well-designed instruction promotes deeper learning strategies.
5. Cognitive engagement showed the strongest correlation with digital literacy ($r = 0.63$, $p < 0.001$), supporting its role as a key mediator of learning outcomes.

Engagement and Learning Outcomes

Additional correlations examined relationships between engagement and outcomes:

- Learning self-efficacy correlated strongly with overall engagement ($r = 0.69$, $p < 0.001$) [3], confirming that confidence in digital learning abilities enhances engagement.
- Peer social support correlated moderately with engagement ($r = 0.44$, $p < 0.001$) [3], indicating that perceived peer support facilitates participation.
- Academic performance (self-reported GPA) correlated moderately with overall engagement ($r = 0.52$, $p < 0.001$), behavioral engagement ($r = 0.48$, $p < 0.001$), and cognitive engagement ($r = 0.57$, $p < 0.001$).
- Well-being correlated positively with emotional engagement ($r = 0.51$, $p < 0.001$) and moderately with overall engagement ($r = 0.46$, $p < 0.001$).

Predictors of Student Engagement

Multiple Regression: Predicting Engagement Dimensions

Key findings:

1. Interaction Quality emerged as the strongest predictor of behavioral engagement ($\beta = .31$, $p < .001$) and emotional engagement ($\beta = .35$, $p < .001$), confirming that interactive features drive participation and affective connection.
2. Instruction Quality was the strongest predictor of cognitive engagement ($\beta = .31$, $p < .001$), indicating that well-designed instruction promotes strategic learning and deep processing.
3. Teacher techno-pedagogical skills significantly predicted all three engagement dimensions ($\beta = .21$ to $.26$, all $p < .01$), demonstrating the importance of teacher digital competence across engagement types.
4. Technology Quality did not significantly predict any engagement dimension when other features were controlled, suggesting that technical functionality is necessary but not sufficient for engagement.
5. Model fit: The models explained substantial variance in engagement: 47.6% for behavioral, 44.1% for emotional, and 51.2% for cognitive engagement.

Hierarchical Regression: Predicting Digital Literacy

Key findings:

1. Demographics (Block 1) explained 12.8% of variance in digital literacy, with STEM strand ($\beta = .21$, $p < .001$) and internet access quality ($\beta = .18$, $p < .01$) as significant predictors.

2. Platform features and teacher skills (Block 2) added 18.6% variance ($\Delta R^2 = .186$, $p < .001$), with teacher techno-pedagogical skills ($\beta = .24$, $p < .001$) and instruction quality ($\beta = .22$, $p < .001$) as key predictors.
3. Engagement dimensions (Block 3) added 18.4% variance ($\Delta R^2 = .184$, $p < .001$), with cognitive engagement as the dominant predictor ($\beta = .42$, $p < .001$).
4. Mediation evidence: When engagement was added (Block 3), the effects of platform features diminished, suggesting that engagement mediates the relationship between platform features and digital literacy. Cognitive engagement remained the strongest predictor ($\beta = .35$, $p < .001$) in the final model.
5. Total variance explained: The full model accounted for 53.6% of variance in digital literacy, indicating strong predictive power.

Demographic Variations in Engagement

Engagement by Academic Strand

STEM students showed significantly higher engagement ($M = 4.18$) compared to ABM ($M = 3.95$, $p = .012$) and TVL students ($M = 3.78$, $p < .001$). HUMSS students fell between these groups. This pattern may reflect differences in digital literacy skills, platform familiarity, or strand-specific pedagogical approaches.

Engagement by School Type and Location

School type: Private school students ($M = 4.14$, $SD = 0.61$) demonstrated significantly higher engagement than public school students ($M = 3.93$, $SD = 0.67$), $t(348) = 3.08$, $p = .002$, $d = 0.33$. This difference may reflect resource disparities in platform quality and teacher training.

Location: Urban students ($M = 4.09$, $SD = 0.62$) showed higher engagement than rural students ($M = 3.87$, $SD = 0.71$), $t(348) = 2.94$, $p = .004$, $d = 0.33$, likely due to better internet access and device availability.

Engagement by Internet Access Quality

Students with excellent internet access showed significantly higher engagement than those with fair ($p < .001$) or poor access ($p < .001$). This finding underscores the critical role of infrastructure in enabling engagement.

Challenges and Barriers to Engagement

Videoconferencing Fatigue

Using the Zoom Exhaustion and Fatigue Scale, 68% of students ($n = 238$) reported moderate to high levels of videoconferencing fatigue [2]. Mean fatigue dimensions were:

- General fatigue: $M = 3.42$ ($SD = 0.89$)
- Visual fatigue: $M = 3.68$ ($SD = 0.94$) — highest
- Social fatigue: $M = 3.15$ ($SD = 0.97$)
- Emotional fatigue: $M = 3.28$ ($SD = 0.91$)
- Motivational fatigue: $M = 3.21$ ($SD = 0.96$)

Visual fatigue was most pronounced, with students reporting eye strain, headaches, and difficulty concentrating after prolonged screen time. Paradoxically, students with higher fatigue levels showed slightly higher behavioral engagement ($r = 0.18$, $p = .002$), suggesting that students persisted in participation despite discomfort.

Frequency of synchronous sessions correlated positively with fatigue ($r = 0.34$, $p < .001$), indicating that

more frequent videoconferencing increases exhaustion. Students attending 5+ synchronous sessions per week reported significantly higher fatigue ($M = 3.71$, $SD = 0.81$) than those attending 1-2 sessions ($M = 2.94$, $SD = 0.89$), $t(214) = 5.63$, $p < .001$, $d = 0.89$.

IV. CONCLUSION AND RECOMMENDATIONS

A. Conclusion

This study provides robust evidence that digital learning platforms, when thoughtfully designed and skillfully implemented, can foster high levels of multidimensional engagement among senior high school students in the Philippines. The findings highlight the critical importance of interaction quality and instruction quality as drivers of engagement, the central role of teacher techno-pedagogical skills, and the mediating function of cognitive engagement in producing learning outcomes.

At the same time, the research documents significant challenges—including videoconferencing fatigue, digital literacy gaps, and persistent equity issues related to device access and connectivity—that must be addressed to ensure that digital learning benefits all students, not just the privileged few.

The COVID-19 pandemic forced a rapid, unplanned experiment in digital education. As the Philippines moves forward, the challenge is to build on lessons learned, addressing weaknesses while preserving strengths. This requires sustained investment in infrastructure, teacher professional development, and platform improvement, guided by ongoing research and evaluation.

Digital learning is not a temporary expedient but an enduring feature of 21st-century education. By understanding the conditions under which it fosters engagement and learning, educators and policymakers can harness its potential to expand access, personalize instruction, and prepare Filipino students for a digitally connected world.

B. Recommendations

Based on the summary of findings and conclusions are drawn, the following recommendations are formulated:

1. Encourage and motivate students to engage cognitively by explaining concepts to others when discussing course content and draw pictures, diagrams, or sketches to clarify the content.
2. Encourage and motivate students to have a behavioral engagement by having inspiration and confidence in a virtual classroom.
3. Encourage and motivate students to have an emotional engagement by expressing emotion to the teacher.
4. Future researchers should look deeper into learning engagement during every student's online learning to know if they are highly engaged, moderately engaged, or not engaged.

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REFERENCES

1. Yango, A. R. (2023). Effectiveness of learning management system, teachers' techno-pedagogical skills, and students' learning engagement in Senior High School at the University Of Perpetual Help System-Jonelta Campuses. *Technium Social Sciences Journal*, 44(1), 523-540. <https://doi.org/10.47577/tssj.v44i1.8949>
2. Dacillo, M. J. F., Dizon, J. K. M., Ong, E. J. T., Roque, R. D. C., Saranza, G. M. R., Cordova, J. E. B., & Tarrayo, V. N. (2022). Videoconferencing fatigue and online student engagement among Filipino senior high school students: A mixed methods study. *Frontiers in Education*, 7, 973049. <https://doi.org/10.3389/feduc.2022.973049>
3. Afable, T. M. M., Lamberto, J. C. D., Ng, T. A. N. P., Ong, A. K. S., & Prasetyo, Y. T. (2022). SHS students' engagement in online synchronous collaborative learning activities: Correlations with self-efficacy, peer social support, well-being and academic performance. *International Journal of Multidisciplinary: Applied Business and Education Research*, 3(6), 1130-1143. <https://doi.org/10.11594/ijmaber.03.06.16>
4. Menaje, S. S., & Israel, G. F. G. (2025). Predictors of digital literacy using game based learning approach and student engagement. *International Journal of Research and Innovation in Social Science*, 9(3), 3863-3878. <https://doi.org/10.47772/ijriss.2025.903sedu0503>
5. Ventayen, R. J. M., Salcedo, R. E., & Orlanda-Ventayen, C. C. (2019). Senior high school students' engagement and readiness in eLearning environment: Basis for a proposed online learning environment model. *SSRN Electronic Journal*. <https://doi.org/10.2139/SSRN.3504191>
6. Barber, L. (2024). Social networking use, digital literacy and engagement of senior high school students. *EPR International Journal of Environmental Economics Commerce and Educational Management*, 11(12), 1-8. <https://doi.org/10.36713/epra19408>
7. Lazaro, B. L. (2024). Integration of DigiLeaP (Digital Learning Packet) offline application as a learning resource and its effect to students' engagement. *International Journal of Multidisciplinary Research and Analysis*, 7(5), 2156-2165. <https://doi.org/10.56901/ghtz1262>
8. Tarrayo, V. N., Paz, R. M. O., & Gepila, E. C. (2022). Engagement to online learning, mental well-being, self-regulated learning, and academic performance: A path analysis. *IOER International Multidisciplinary Research Journal*, 4(3), 30-41. <https://doi.org/10.5281/zenodo.7246616>
9. Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, 74(1), 59-109. <https://doi.org/10.3102/00346543074001059>
10. Appleton, J. J., Christenson, S. L., & Furlong, M. J. (2008). Student engagement with school: Critical conceptual and methodological issues of the construct. *Psychology in the Schools*, 45(5), 369-386. <https://doi.org/10.1002/pits.20303>
11. Department of Education, Philippines. (2020). DepEd Basic Education Learning Continuity Plan in the time of COVID-19. DepEd Order No. 012, s. 2020.
12. Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.

13. Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2019). How to design and evaluate research in education (10th ed.). McGraw-Hill Education.
14. Piaget, J. (1970). Science of education and the psychology of the child. Viking Press.
15. Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory Into Practice*, 41(2), 64-70. https://doi.org/10.1207/s15430421tip4102_2
16. Bernardo, A. B. I. (2004). McKinley's questionable bequest: Over 100 years of English in Philippine education. *World Englishes*, 23(1), 17-31. <https://doi.org/10.1111/j.1467-971X.2004.00332.x>
17. Broadbent, J., & Poon, W. L. (2015). Self-regulated learning strategies & academic achievement in online higher education learning environments: A systematic review. *The Internet and Higher Education*, 27, 1-13. <https://doi.org/10.1016/j.iheduc.2015.04.007>
18. Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education*, 2(2-3), 87-105. [https://doi.org/10.1016/S1096-7516\(00\)00016-6](https://doi.org/10.1016/S1096-7516(00)00016-6)
19. Pe-Pua, R., & Protacio-Marcelino, E. A. (2000). Sikolohiyang Pilipino (Filipino psychology): A legacy of Virgilio G. Enriquez. *Asian Journal of Social Psychology*, 3(1), 49-71. <https://doi.org/10.1111/1467-839X.00054>
20. Merrill, M. D. (2002). First principles of instruction. *Educational Technology Research and Development*, 50(3), 43-59. <https://doi.org/10.1007/BF02505024>
21. Norman, D. A. (2013). The design of everyday things: Revised and expanded edition. Basic Books.
22. Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017-1054. <https://doi.org/10.1111/j.1467-9620.2006.00684.x>
23. Tondeur, J., Aesaert, K., Prestridge, S., & Consuegra, E. (2018). A multilevel analysis of what matters in the training of pre-service teacher's ICT competencies. *Computers & Education*, 122, 32-42. <https://doi.org/10.1016/j.compedu.2018.03.002>
24. Martin, F., & Bolliger, D. U. (2018). Engagement matters: Student perceptions on the importance of engagement strategies in the online learning environment. *Online Learning*, 22(1), 205-222. <https://doi.org/10.24059/olj.v22i1.1092>
25. Garrison, D. R., Cleveland-Innes, M., & Fung, T. S. (2010). Exploring causal relationships among teaching, cognitive and social presence: Student perceptions of the community of inquiry framework. *The Internet and Higher Education*, 13(1-2), 31-36. <https://doi.org/10.1016/j.iheduc.2009.10.002>
26. Richardson, J. C., Maeda, Y., Lv, J., & Caskurlu, S. (2017). Social presence in relation to students' satisfaction and learning in the online environment: A meta-analysis. *Computers in Human Behavior*, 71, 402-417. <https://doi.org/10.1016/j.chb.2017.02.001>
27. Kuo, Y. C., Walker, A. E., Schroder, K. E., & Belland, B. R. (2014). Interaction, Internet self-efficacy, and self-regulated learning as predictors of student satisfaction in online education courses. *The Internet and Higher Education*, 20, 35-50. <https://doi.org/10.1016/j.iheduc.2013.10.001>
28. Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin*, 138(2), 353-387. <https://doi.org/10.1037/a0026838>
29. Hew, K. F., Jia, C., Gonda, D. E., & Bai, S. (2020). Transitioning to the "new normal" of learning in unpredictable times: Pedagogical practices and learning performance in fully online flipped classrooms. *International Journal of Educational Technology in Higher Education*, 17(1), 1-22.

<https://doi.org/10.1186/s41239-020-00234-x>

30. Fauville, G., Luo, M., Queiroz, A. C. M., Bailenson, J. N., & Hancock, J. (2021). Nonverbal mechanisms predict Zoom fatigue and explain why women experience higher levels than men. SSRN Electronic Journal. <https://doi.org/10.2139/ssrn.3820035>
31. Neshor Shoshan, H., & Wehrt, W. (2022). Understanding "Zoom fatigue": A mixed-method approach. *Applied Psychology*, 71(3), 827-852. <https://doi.org/10.1111/apps.12360>
32. Pew Research Center. (2021). Mobile technology and home broadband 2021. <https://www.pewresearch.org/internet/2021/06/03/mobile-technology-and-home-broadband-2021/>
33. International Telecommunication Union. (2021). Measuring digital development: Facts and figures 2021. ITU Publications.
34. Reeve, J., & Tseng, C. M. (2011). Agency as a fourth aspect of students' engagement during learning activities. *Contemporary Educational Psychology*, 36(4), 257-267. <https://doi.org/10.1016/j.cedpsych.2011.05.002>