Journal of School and Educational Psychology
2024, Vol. 4, No. 1, 1-10
https://doi.org/10.47602/josep.v4i1.52
https://journalofschoolpsychology.com

RESEARCH ARTICLE

The Impact of Synchronous Zoom Learning on Course Comprehension and Psychological Well-Being in the College Classroom

Melissa Huey*

Abstract

The present study aimed to investigate the optimal learning environment for synchronous Zoom learning courses in terms of course comprehension and psychological well-being. Several courses in the Psychology and Counselling Department (N=473) agreed to participate in the study, and were assigned to one of the three Zoom conditions: 1. Camera use (cameras mandatory, cameras encouraged, or no restrictions) 2. Breakout rooms (breakout rooms used during class or not); and 3. Background (a calm, relaxing virtual background or no background). At the end of the semester, students filled out a brief survey about their course comprehension and psychological well-being in the classroom. The results found that students who had cameras mandatory or encouraged during class and students who had a calm, relaxing background had significantly higher levels of mindfulness and course comprehension. In addition, results found that courses that did *not* utilize breakout rooms had significantly higher levels of course comprehension and mindfulness as compared to the control group. The results from this study provide practical solutions for creating a positive learning experience in synchronous online classrooms. Understanding the importance of which Zoom conditions create the best learning environment can allow institutions and instructors alike to employ effective teaching strategies to help students continue to be successful in higher education, regardless of which teaching modality is employed.

Keywords: College Students; Course Comprehension; Student Mindfulness; Anxiety; Online Learning

Introduction

With the onset of the COVID-19 pandemic, college campuses across the U.S. switched to remote learning. Many of them use video conferencing tools, such as Zoom, to offer online courses. The use of distance learning techniques such as video conferences is not new to higher education, however, many instructors have used these techniques to communicate in real-time (e.g., Anastadisades et al., 2010; Ghazal et al., 2015; & Oh & Lee, 2012). Ample studies have investigated comparisons between in-person and online learning (e.g., dela Cruz et al., 2020; Race et al., 2021 Wang, 2021), and as the pandemic necessitated the shift to remote learning, additional studies have explored online learning specifically during the COVID-19 pandemic (Adnan & Anwar, 2020; Bao, 2020; Demuyakor, 2020; Murphy, 2020; Toquero, 2020). Nonetheless, there are very few studies which have investigated what specific conditions optimize the synchronous Zoom learning environment.

Research has found that there are some benefits to the Zoom environment - increased educational resources (Stefanile, 2020), flexibility for the learner (Serhan, 2020), and equal opportunities for students and teachers, to name a few (e.g., Dhawan, 2020). Yet many educators would agree that the Zoom environment provides a suboptimal learning experience (e.g., Serhan, 2020). Inadequate communication – both verbal and nonverbal - between teacher and students (Peper et al., 2021), Zoom fatigue (Bullock et al., 2021), and most importantly, a lack of connection between the teacher and learner (Midcalf & Boatwright, 2020). Despite the challenges that arise with Zoom learning, it is here to stay, and therefore it's essential to investigate how to create the best experience for students who are learning synchronously online.

*New York Institute of Technology, USA
Corresponding Author: Melissa Huey, New York Institute of Technology – New York City Campus, 16 West 61st Street, New York, NY 10023, USA; E-mail: mhuey@nyit.edu

One important factor for learning is course comprehension. Students who fully comprehend the course material in university settings do better in the course, get more out of the material, and retain information from the course for longer (Fisher et al., 2021). There is limited research on the effects of the online classroom experience and course comprehension. Although preliminary evidence points to a decrease in course comprehension in the Zoom environment (Means et al., 2009), few studies confirm this effect.

In addition, few studies have looked at how the Zoom environment impacts the students' course-related psychological well-being. Anxiety is particularly problematic among college students, with 63% of college students feeling an overwhelming amount of anxiety in the past year alone (American College Health Association, 2021). Anxiety significantly impedes the learning experience (Mazzone et al., 2007) as feelings of anxiousness in the classroom can evoke a flight or fight response (Lain, 2016), and impair the ability to absorb new information (Bai et al., 2020). Research has found that Zoom classrooms may be a significant source of anxiety for students (Deniz et al., 2022), given that being on screen during class can produce a tremendous amount of increased stress (Li et al., 2022) which in turn, may result in increased anxiety (Stankovic et al., 2021).

Research has found that mindfulness – defined as the quality or state of being conscious or aware of present surroundings – is another important part of psychological well-being in the classroom. Mindfulness is associated with better grades (Caballero et al., 2019), reduced anxiety (Hoffman et al., 2010), and better overall psychological health (Mahfouz et al., 2018; Yildirim et al., 2022). This is particularly impactful in the online classroom setting. While in-person classes allow a disconnect from technology, which often increases mindfulness in the classroom (Huey & Giguere, 2021), the Zoom environment does not afford this same disconnect. Frequent alerts, notifications, and constant streams of information can inherently create a disruption, as students are aware of other things going on outside of class. The student may not only experience fear of missing out (e.g., Manap et al., 2023), but the distraction causes students to disengage from class material (Cowit & Barker, 2022; Kostaki & Karayianni, 2022).

Aim and hypotheses of the study

Although there are previous studies which compared in-person and online learning (e.g. Dela Cruz, 2020), and other studies that investigate online learning specifically during the COVID-19 pandemic (e.g. Bao, 2020), there is a gap in the literature in terms of specific conditions in Zoom learning and its relationship to the quality of the classroom experience. In the present study, students participated in courses where three different conditions were assigned: 1. Camera use (cameras mandatory, cameras encouraged, or no restrictions); 2. Breakout rooms (the class incorporated breakout rooms, or no breakout rooms during the course); 3. Background (students were assigned to put on a calm/relaxing background of their choice, or no instructions were given). Students completed a survey to measure levels of course comprehension and psychological well-being based on these conditions. The present study tested three hypotheses:

H1: Students who had cameras mandatory or cameras encouraged had significantly different levels of course comprehension and psychological well-being than students who had no instructions on camera use (control group).

H2: Students who had courses that incorporated breakout rooms had significantly different levels of course comprehension and psychological well-being than students who had no breakout rooms in their course (control group).

H3: Students who were instructed to put on a calm relaxing background had significantly different levels of course comprehension and psychological well-being than students who had no background instructions incorporated into the class (control group).

Method

Participants

Participants were undergraduate students at the New York Institute of Technology, a primarily undergraduate institution in New York City. A convenience sample was used, surveying a range of professors who agreed to have their courses participate within the Psychology and Counseling Department. As presented in Table 1, the participants (N = 473) included 243 females (51%), 225 males (48%), and 5 participants identified as other (1%).

Of this total, 204 were Asian American (43%), 142 identified as White / Caucasian (30%), 52 identified as Latinx or Hispanic (11%), 33 identified as Black / African American (7%), and 42 were other (9%). Students ranged in age from 18 to 36 (M = 20.2, SD = 2.4). Ethical approval was granted by the New York Institute of Technology Review Board (Protocol number: ESB 1589).

Table 1. Demographics of Study Sample (N = 473)

Variable	*N*	*%*
Gender		
Male	225	48
Female	243	51
Other	5	1
Ethnicity		
Asian American	204	43
White / Caucasian	142	30
Latinx or Hispanic	52	11
Black / African American	33	7
Other	42	9
Education		
Freshman	89	19
Sophomore	184	39
Junior	106	22
Senior	93	20

Measures

Zoom Conditions

Questions were included in a survey that asked participants about various Zoom conditions. Participants were asked three specific questions about Zoom conditions: 1. “Is it mandatory to have your video turned on during class?” 2. “Does this class utilize breakout rooms?” and 3. “What is the background of your Zoom screen?”

Students’ Perception of Course Comprehension

A 10-item questionnaire was created, which specifically assessed how engaged students’ perceptions of course comprehension during the course. Sample items included, “I feel confident in my knowledge of the course material,” or “It is clear to me what concepts I do not understand after the lecture.” Questions ranged on a scale from “1” – strongly disagree – to “5” – strongly agree. The items were averaged and reliability was very good ($\alpha = .91$, $\omega = .91$). A reliability analysis was conducted, and was best when all 10 items were included in the scale. In addition, a principal component analysis was conducted to investigate construct validity. All ten items had eigenvalues over Kaiser’s criterion of 1 and the cumulative variance explained was 57.47%. See Appendix A for questions.

Students’ Perception of Anxiety

A 7-item questionnaire was created, which specifically assessed student perceptions of anxiety during class. Sample items included “During class, I feel nervous, anxious, or on edge” or “During class, I have trouble relaxing.” Questions ranged on a scale from “1” – not at all – to “5” – all the time. The items were averaged and reliability was very good ($\alpha = .94$, $\omega = .94$). A reliability analysis was conducted, and was best when all 7 items were included in the scale. In addition, a principal component analysis was conducted to investigate construct validity. All seven items had eigenvalues over Kaiser’s criterion of 1 and the cumulative variance explained by the 7 items was 74.86%. See Appendix B for questions.

Students’ Perception of Mindfulness

A 10-item questionnaire was created which specifically assessed students’ perception of mindfulness during their respective courses. Sample items included, “I take notes on autopilot, without truly processing the information” and “I am focused on outside responsibilities or tasks during class.” Questions ranged on a scale from “1” – strongly disagree – to “5” – strongly agree. The items were averaged and reliability was very good. ($\alpha = .94$, $\omega = .94$). A

reliability analysis was conducted and was best when all 10 items were included in the scale. In addition, a principal component analysis was conducted to investigate construct validity. All ten items had eigenvalues over Kaiser's criterion of 1 and the cumulative variance explained was 66.42%. See Appendix C for questions.

Procedure

Students were recruited from the Psychology and Counseling Department at the New York Institute of Technology. Instructors in each class agreed to random assignment for one of the conditions for each of the three factors. First, cameras during the class were either mandatory (n = 116), encouraged (n = 249), or there were no restrictions (n = 106). In the mandatory condition, instructors explicitly told students that cameras were required to be turned on for the course. In the encouraged condition, instructors encouraged students to utilize their cameras (e.g. "If possible, please put on your cameras"), but did not make it a requirement of the course. In the no-restrictions condition, instructors did not mention camera or video use at all. The second condition was whether instructors utilized breakout rooms (n = 87) or not (n = 130) during the Zoom lecture. For the last condition, the instructor either asked students to use a calm, relaxed background that was provided through the Zoom platform (e.g. the ocean, the Golden Gate Bridge) (n = 383), or the instructor made no mention of a specific background (n = 58). Instructors agreed to administer the survey at the end of the semester. Towards the end of the semester in Fall 2020 and Spring 2021, research assistants joined the Zoom class to explain the details of the survey and answer any questions. Students consented to the survey by clicking on the link to complete it via Qualtrics. The survey took about 10-15 minutes to complete and asked students which specific Zoom conditions they had during their course, as well as their levels of course comprehension, mindfulness, and anxiety during the course. All students completed the survey in class immediately following the lecture.

Data Analysis

A one-way ANOVA examined the effects of camera requirements (via Zoom) on the overall student perception of course comprehension and psychological well-being. Results indicated whether there are mean-level differences between courses with cameras mandatory, cameras encouraged, and no restrictions. An independent samples t-test examined the effects of breakout rooms (via Zoom) on the overall student perception of course comprehension and psychological well-being. Results indicated whether there are mean-level differences between classes with breakout rooms and classes without. Another independent samples t-test examined the effects of backgrounds (via Zoom) on the overall student perception of course comprehension and psychological well-being. Results indicated whether there are mean-level differences between classes where students had a calm, relaxing background and students with no specific background.

Results

Hypothesis 1a: Camera Use and Course Comprehension

A one-way ANOVA examined the effect camera requirements (via Zoom) had on the overall course comprehension of the students. Results indicated statistically significant differences in course comprehension, $F(2, 465) = 3.00$, $p = .05$ between groups. Post-hoc comparisons using the Tukey HSD test indicated that students who had cameras mandatory (M=3.79, SD=.79) or encouraged (M = 3.79, SD = .73) had significantly higher levels of course comprehension than students with no camera restrictions (M = 3.59, SD = .64). Interestingly, there were no significant differences between students who had cameras mandatory versus cameras encouraged.

Hypothesis 1b: Camera Use and Psychological Well-Being

A one-way ANOVA examined the effect of camera requirements via Zoom on the overall psychological well-being of the students. Results indicated no statistically significant differences in anxiety based on camera use, $F(2, 466) = 0.69$, $p = .50$, however, there were significant differences in mindfulness, $F(2, 464) = 10.59$, $p < 01$. Post-hoc comparisons using the Tukey HSD test indicated that there were significant differences between all three groups. Students whose cameras were mandatory had significantly higher levels of mindfulness (M = 3.64, SD = .89) than students whose cameras were encouraged (M = 3.45, SD = .92). Students who had no restrictions had significantly lower levels of mindfulness (M =3.10, SD = .95) than both those with cameras mandatory and cameras encouraged. See Table 2 for all means and standard deviations.

Hypothesis 2a: Breakout Rooms and Course Comprehension

An independent sample t-test examined the effect of breakout rooms on course comprehension during the course. Results indicated statistically significant differences in course comprehension, $t(212) = 2.78$, $p = .01$. Surprisingly, the courses that used breakout rooms had significantly lower levels of course comprehension ($M = 3.64$, $SD = .73$) than courses that did not use breakout rooms ($M = 3.90$, $SD = .72$).

Table I. Means and Standard Deviations of Study Variables by Condition

Condition	*Course Comprehension*	*Anxiety*	*Mindfulness*
Camera			
Mandatory	3.79 (.79)*	2.16 (1.14)	3.64 (.89)*
Encouraged	3.79 (.73)	2.05 (1.05)	3.45 (.92)
No Restrictions	3.59 (.64)*	2.18 (1.06)	3.10 (.95)*
Background			
Calm, relaxing	4.01 (.54)*	1.94 (.97)	3.81 (.70)*
No restrictions	3.71 (.75)	2.11 (1.09)	3.35 (.93)
Breakout Rooms			
Yes	3.64 (.73)*	2.07 (.95)	3.38 (.90)
No	3.90 (.73)*	2.06 (1.10)	3.50 (.88)

$N = 473$. * $p < .05$, ** $p < .01$ indicates a significant difference between groups.

Hypothesis 2b: Breakout Rooms and Psychological Well-Being

An independent sample t-test examined the effect of breakout rooms on psychological well-being during the course. Results indicated that there were no statistically significant differences in anxiety, $t(213) = .08$, $p = .93$, and no statistically significant differences in mindfulness, $t(213) = -.73$, $p = .47$, between courses that used breakout rooms and courses that did not. See Table 2 for all means and standard deviations.

Hypothesis 3a: Zoom Background and Course Comprehension

An independent sample t-test examined the effect of zoom backgrounds on course comprehension during the course. Results indicated statistically significant differences in course comprehension, $t(437) = -2.94$, $p < .01$. Students that had calm, relaxing backgrounds had significantly higher levels of course comprehension ($M = 4.01$, $SD = .54$) than students that had no specific background ($M = 3.71$, $SD = .75$).

Hypothesis 3b: Zoom Background and Psychological Well-Being

An independent sample t-test examined the effect of zoom backgrounds on psychological well-being during the course. Results indicated there were no statistically significant differences in anxiety, $t(438) = 1.12$, $p = .26$, between students who had a calm, relaxing background and those who did not. However, results indicated there were statistically significant differences in mindfulness, $t(436) = -4.44$, $p < .01$, based on background. Students with a calm, relaxing background had significantly higher levels of mindfulness ($M = 3.81$, $SD = .70$) than students with no specific background ($M = 3.35$, $SD = .93$). See Table 2 for all means and standard deviations.

Discussion

The goal of this study was to explore what conditions create the best outcomes for students in terms of psychological well-being and course comprehension for courses taken via Zoom. In line with the first hypothesis, results found that students who had cameras mandatory or cameras encouraged in their classes had significantly higher levels of mindfulness and course comprehension than those without restrictions. Prior research has found that students who fully comprehend the course material do better in the course and retain the information for longer (Fisher et al., 2021), and this study provides evidence that having cameras on during class helps students comprehend the material. Higher course comprehension may also be associated with increased mindfulness, as students who are more mindful during lecture are more likely to retain the material (Huey & Giguere, 2021). Mindfulness in class is also associated with better overall psychological health (Mahfouz et al., 2018). In the case of the Zoom environment, being "mindful" in class may be increased in classes where cameras are mandatory, and therefore students are less likely to be distracted by outside stimuli. Although Zoom conditions cannot fully recreate the in-person experience, having cameras as an expectation for the course encourages students to remain engaged and actively involved in the class,

more closely mirroring the in-person environment. It is interesting to note that there were no significant differences between courses that made cameras mandatory versus cameras encouraged. This indicates the professor simply setting the expectation of the camera is enough for students to stay involved.

For the second hypothesis, results found that students whose classes did not use breakout rooms had higher levels of course comprehension than courses whose classes used breakout rooms. Breakout rooms may not mirror the positive impact of small-group work in the classroom (Howe et al., 2019). Namely, breakout rooms are missing the 'facilitator' component of the instructor. Often the instructor will jump from group to group to check in on the students, which is possible via Zoom but cannot happen seamlessly as it does in the classroom. With breakout rooms, students are left in a room alone and therefore do not have the accountability to do the activity cohesively to reinforce the material.

For the third hypothesis, the results found that students who were instructed to use a calm, relaxing background had significantly higher levels of mindfulness and course comprehension than those with no pictured background. The fact that synchronous Zoom lectures often take place at home can lend itself to countless distractions for students. For instance, parent interruptions, household work, televisions, and other siblings around the house can all interrupt a student's attention (Peper et al., 2021). Research has found that distractions can impede student learning (e.g. Brady et al., 2021) and our results solidify this information. In the context of Zoom, a calm, relaxing background may put students at ease, limit distractions, and help students engage in the lecture rather than what is happening at home.

Limitations, implications and future research

This study is not without limitations. First, the conclusions that were drawn were limited by the design of the study and the measures we used. Concerning the study design, participants were drawn from different Psychology and Counselling classes, and different instructors taught each of those classes. Additionally, our design examined whether the Zoom conditions affect the classroom experience across students, with each student reporting on one condition from each factor. While the outcomes of the study relied on self-report data from non-validated questionnaires, these measures have been published in other studies (Huey & Giguere, 2022). Self-report data can be biased and future studies should include objective measures of course comprehension (e.g. grade in class) and psychological well-being (e.g. current use of antidepressant drugs). While self-report measures have limitations, the bias associated with these measures was evenly distributed across conditions, and therefore the effect of the condition cannot be explained by reliance on self-report data. While many valid and reliable measures of anxiety and mindfulness exist, none perfectly fit the aim of the present study – to examine these constructs confined to the experience in one specific Zoom classroom. Thus, questionnaires were created to fit the study design. Only items with face validity were included, and each item was meant to examine the larger construct directly and clearly. Additionally, the high-reliability scores suggest that these items were testing a single construct.

Although each class included in the study was in the Psychology and Counselling Department, future studies may investigate the effects of the Zoom conditions in the classroom using the same classes or a single instructor to avoid potential confounds. Additionally, future studies should include a pre- and post-design, where a baseline assessment of the outcomes at the beginning of the semester is collected, and again at the end to examine whether Zoom conditions have a within-student effect. It would also be pertinent to control for the other two Zoom factors while investigating one factor at a time to strengthen the validity of the results. The use of non-validated questionnaires also limits the validity of the results, and therefore future lines of research can use the items from the present study and items from the validity measures to ensure high convergent validity.

The results from this study suggest that not all synchronous online learning is created equal, and there are important factors that contribute to a positive Zoom classroom. In particular, cameras mandatory or encouraged, and a calm, relaxing virtual background increase the student's overall classroom experience. On the contrary, breakout rooms may inhibit students' comprehension of course material, and in turn, decrease the student experience. This information is pertinent for universities and educators as courses continue to be offered in this modality.

Conclusion

Given the evolution of online learning, students will continue to take synchronous classes within higher education institutions. This study provides practical solutions for creating a positive student learning experience in synchronous classrooms. Simple applications such as encouraging students to put their cameras on for lectures, or asking for a calm background on their computer screen, can have a positive impact on the student experience. Institutions and instructors alike can make use of this information to make practical changes to synchronous learning requirements to help create a positive student experience in the classroom.

Compliance with Ethical Standards

Acknowledgements

I would like to thank all the professors who voluntarily participated in the study for their time and their valuable contribution.

Competing interests

The author declares that there are no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

ORCID

Melissa Huey https://orcid.org/0000-0002-6207-2005

Received: July 04, 2023
Accepted: September 21, 2023
Published Online: February 4, 2024

References

Adnan, M., & Anwar, K. (2020). Online learning amid the COVID-19 pandemic: Students' perspectives. *Journal of Pedagogical Sociology and Psychology*, 2(1), 45-51. doi: 10.33902/JPSP.2020261309

American College Health Association: National College Assessment (2022, Spring). Publications and Reports: Retrieved from www.acha.org.

Anastasiades, P., Filippousis, G., Karvunis, L., Siakas, S., Tomazinakis, A., Giza, P., & Mastoraki, H. (2010). Interactive Videoconferencing for collaborative learning at a distance in the school of 21st century: A case study in elementary schools in Greece. *Computers & Education*, 54, 321–339. doi: 10.1016/j.compedu.2009.08.016.

Bao, W. (2020). COVID-19 and online teaching in higher education: A case study of Peking University, *Human Behavior and Emerging Technologies, 2*(2), 113-115, Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1002/hbe2.191

Bai, X., Wang, X., Wang, J., Tian, J., & Ding, Q. (2020). College students' autonomous learning behavior in blended learning: Learning motivation, self-efficacy, and learning anxiety. *2020 International Symposium on Education Technology (ISET)*, 155-158. doi: 10.1109/ISET49818.2020.00042

Brady, A. C., Kim, Y. E., & Cutshall, J. (2021). The what, why, and how of distractions from a self-regulated learning perspective. *Journal of college reading and learning*, *51*(2), 153-172. doi: 10.1080/10790195.2020.1867671

Bullock, A., Colvin, A. D., & Jackson, M. S. (2022). Zoom fatigue in the age of COVID-19. *Journal of Social Work in the Global Community*, *6*(1), 1-9. doi: 10.5590/JSWGC.2022.07.1.01

Caballero, C., Scherer, E., West, M. R., Mrazek, M. D., Gabrieli, C. F., & Gabrieli, J. D. (2019). Greater mindfulness is associated with better academic achievement in middle school. *Mind, Brain, and Education*, 13(3), 157-166. doi: 10.1111/mbe.12200

Cowit, N. & Barker, L. J. (2022). Student perspectives on distraction and engagement in the synchronous remote classroom. *Digital Distractions in the College Classroom*, 243-266. doi: 10.4018/978-1-7998-9243-4.ch012

Dela Cruz, A. M., Alick, S., Das, R., & Brenner, A. (2020). Same material, different formats: comparing in-person and distance learning in undergraduate medical education. *Academic Psychiatry*, *44*, 659-663. doi: 10.1007/s40596-020-01333-7

Demuyakor, J. (2020). Coronavirus (COVID-19) and online learning in higher institutions of education: A survey of the perceptions of Ghanaian international students in China. *Online Journal of Communication and Media Technologies*, 10(3), 1-9. Doi: 10.29333/ojcmt/8286.

Deniz, M. E., Satici, S. A., Doeynas, C., & Griffiths, M. D. (2022). Zoom fatigue, psychological distress, life satisfaction, and academic well-being. *Cyberpsychology, Behavior, and Social Networking*, 25(5), 270-277. doi: 10.1089/cyber.2021.0249

Dhawan, S. (2020, September). Online Learning: A Panacea in the Time of COVID-19 Crisis. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7308790/

Fisher, M. E., Dorner, M. A., Maghzi, K. S., Achieng-Evensen, C., Whitaker, L. C., Hansell, F. Gapinski, S. M. (2021). Liminality, disruption, and change: A prismatic look pandemic education. *Prospects, 51*, 523-540. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8240074/

Ghazal, S., Samsudin, Z., & Aldowah, H. (2015). Students' perception of synchronous courses using skype- based video conferencing. *Indian Journal of Science and Technology*, 8(30), 1-10. Retrieved from http://www.indjst.org/ index.php/indjst/article/viewFile/84021/64976

Hoffman, S. G., Sawyer, A. T., Witt, A. A., & Oh, D. (2010). The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review. *Journal of Consulting and Clinical Psychology*, 78(2), 169-175. Doi: 10.1037/a0018555

Howe, C., Hennessy, S., Mercer, N., Vrikki, M., & Wheatley, L. (2019). Teacher–student dialogue during classroom teaching: Does it really impact on student outcomes? *Journal of the Learning Sciences*, 28(4-5), 462-512. doi: 10.1080/10508406.2019.1573730

Huey, M. & Giguere, D. (2022). The impact of smartphone use on course comprehension and psychological well-being in the college classroom. *Innovative Higher Education, 1-11*, doi: 10.1007/s10755-022-09638-1

Kostaki, D. & Karayianni, I. (2022). Houston, we have a pandemic: Technical difficulties, distractions and online student engagement. *Student Engagement in Higher Education Journal*, 4(2), 105-127. Retrieved from https://sehej.raise-network.com/raise/article/view/1063

Lain E. (2016). Experiences of academically dismissed black and Latino law students: Stereotype threat, fight or flight coping mechanisms, isolation and feelings of systemic betrayal. *Journal of Law and Education*, 45(3) 279-326.

Li, N., Rodriguez, G. R., Xu, Y., Bhatt, P., Nguyen, H. A., Serpi, A., Tsai, C., & Carroll, J. M. (2022). Picturing One's Self: Camera Use in Zoom Classes during the COVID-19 Pandemic. *In Proceedings of the Ninth ACM Conference on Learning@ Scale*, 151-162. doi: 10.1145/3491140.3528284.

Mahfouz, J., Levitan, J., Schussler, D., Broderick, T., Dvorakova, M.A., & Greenberg, M. (2018). Ensuring college student success through mindfulness-based classes: Just breathe. *College Student Affairs Journal, 36*(1), 1-16. doi: 10.1353/csj.2018.0000

Manap, A., Rizzo, A., Yıldırmaz, A., Dilekçi, Ü., & Yıldırım, M. (2023). The Mediating Role of Procrastination in the Relationship between Fear of Missing Out and Internet Addiction in University Students. *International Journal of Environmental Research and Public Health, 21*(1), 1-14. Doi: 10.3390/ijerph21010049

Mazzone, L., Ducci, F., Scoto, M. C., Passanti, E., D'Arrigo, V. G., & Vitello, B. (2007). The role of anxiety symptoms in school performance in a community sample of children and adolescents. *BMC Public Health*, 7(1), 1-6. Doi: 10.1186/1471-2458-7-3.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009, April 30). Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies. Retrieved from https://eric.ed.gov/?id=ED505824

Midcalf, L., & Boatwright, P. (2020). Teacher and Parent Perspectives of the Online Learning Environment Due to Covid-19. *Delta Kappa Gamma Bulletin*, *87*(1), 24-34.

Murphy, M. P. (2020). COVID-19 and emergency eLearning: Consequences of the securitization of higher education for post-pandemic pedagogy. *Contemporary Security Policy*,1-14. Doi: 10.1080/13523260.2020.1761749

Oh, Y. B., & Lee, C. D. (2012). The effect of class satisfaction and self-efficacy on English class using video conferencing. *Journal of Digital Convergence*, 10(8), 317-326. Doi: 10.14400/JDPM.2012.10.8.317

Peper, E., Wilson, V., Martin, M., Rosegard, E., & Harvey, R. (2021). Avoid Zoom fatigue, be present and learn. *NeuroRegulation*, 8(1), 47-47. doi: 10.15540/nr.8.1.47

Race, A. I., De Jesus, M., Beltran, R. S., & Zavaleta, E. S. (2021). A comparative study between outcomes of an in-person versus online introductory field course. *Ecology and Evolution*, *11*(8), 3625-3635. doi: 10.1002/ece3.7209

Serhan, D. (2020). Transitioning from Face-to-Face to Remote Learning: Students' Attitudes and Perceptions of Using Zoom during COVID-19 Pandemic. *International Journal of Technology in Education and Science*, *4*(4), 335-342. https://files.eric.ed.gov/fulltext/EJ1271211.pdf

Stankovic, M., Nesic, M, Cicevic, S., & Shi, Z. (2021). Association of smartphone use with depression, anxiety, stress, sleep quality, and internet addiction. Empirical evidence from a smartphone application. *Personality and Individual Differences*, 168. doi: 10.1016/j.paid.2020.110342

Stefanile, A. (2020). The transition from classroom to Zoom and how it has changed education. *Journal of Social Science Research*, *16*(1), 33-40. Doi: 10.24297/jssr.v16i.8789

Toquero, C. M. (2020). Challenges and opportunities for higher education amid the COVID-19 pandemic: The Philippine context. Pedagogical Research, 5(4), 1-5. doi: 10.29333/pr/7947

Wang, C. (2021, July). Virtual vs. In-Person Learning: A Study on Student Motivation, Experience, and Perception in a First-Year Introduction to Engineering Course. In *2021 ASEE Virtual Annual Conference Content Access*.

Yildirim, M., Aziz, I. A., Nucera, G., Ferrari, G., & Chirico, F. (2022). Self-compassion mediates the relationship between mindfulness and flourishing. *Journal of Health and Social Sciences*, 7(1), 89-98. Doi: 0000-0003-1089-1380

Appendix A – Course Comprehension

1 – Strongly disagree
2 – Disagree
3 – Neutral
4 – Agree
5 – Strongly agree

1. I am learning a lot in this course.
2. I feel confident in my knowledge of the course material.
3. It is clear to me what concepts I do not understand after lecture.
4. I feel like I can apply the knowledge I learn in this course to new situations.
5. I have developed new study strategies that have helped me learn the material.
6. I feel like I can apply what I learn in this course to life outside of school.
7. I often feel confused after class (reverse-coded).
8. I feel like I am able to identify points of confusion.
9. I have been able to learn from my successes and struggles in this course
10. I feel confident explaining most of the concepts or principles learning in this course to someone else

Appendix B – Anxiety

1 – Strongly disagree
2 – Disagree
3 – Neutral
4 – Agree
5 – Strongly agree

1. During class, I feel nervous, anxious, or on edge.
2. During class, I am not able to stop or control worrying.
3. During class, I often worry too much about different things.
4. During class, I have trouble relaxing.
5. During class, I am so restless that it's hard to sit still.
6. During class, I become easily annoyed or irritable.
7. During class, I feel worried that something bad will happen.

Appendix C – Mindfulness

1 – Strongly disagree
2 – Disagree
3 – Neutral
4 – Agree
5 – Strongly agree

1. Although I am in class, I am often not paying attention
2. My mind if rarely focused on what is going on in class.
3. In class, it seems as I am running on autopilot without much attention to what the professor is saying.
4. I am often focused on outside responsibilities or tasks during class.
5. I take notes on autopilot, without truly processing the information.
6. During class, I find myself preoccupied with the future or the past.
7. Often in class I am listening, but not fully engaged in the material.
8. In class, I am often doing other activities.
9. I find it difficult to pay attention to what's happening during class.
10. I often think about class as an opportunity to do other work.