2023 Annual Conference & Exposition
Baltimore Convention Center, MD | June 25 - 28, 2023
The Harbor of Engineering Education for 130 Years
ASEE
Paper ID #39326

Work in Progress: Introducing a coffee break to improve exam performance and reducing student stress in construction majors

Raúl Esteban Toscano
Vanessa Guerra, University of Virginia
Dr. Miguel Andres Guerra, Universidad San Francisco de Quito USFQ

MiguelAndres is an Assistant Professor in the Polytechnic College of Science and Engineering at Universidad San Francisco de Quito USFQ. He holds a BS in Civil Engineering from USFQ, a M.Sc. in Civil Engineering in Construction Engineering and Project Management from Iowa State University, a Ph.D. in Civil Engineering with emphasis in Sustainable Construction from Virginia Tech, and two Graduate Certificates from Virginia Tech in Engineering Education and Future Professoriate and from USFQ in Structures for Construction Professionals. MiguelAndres's research includes Architectural and Civil Engineering Project Management, Sustainable and Resilient Urban Infrastructure, and the development of engineers who not only have strong technical and practical knowledge but the social awareness and agency to address global humanitarian, environmental, and social justice challenges. For him, social justice is a concept that should always be involved in discussions on infrastructure. Related to STEM education, Miguel Andres develops disruptive pedagogies for STEM courses as a tool for innovation, and assessing engineering students' agency to address climate change. Currently, MiguelAndres is working on a framework to support and conduct undergraduate research.

Work in Progress: Introducing a coffee break to improve exam performance and reducing student stress in construction majors

Raúl Toscano[1], Vanessa Guerra[2], Miguel Andrés Guerra[3*]

[1] Undergraduate student, Universidad San Francisco de Quito USFQ, Colegio de Ciencias e Ingenierías, Departamento de Ingeniería Civil, Casilla Postal 17-1200-841, Quito 170901, Ecuador.
[2] Assistant Professor, University of Virginia, School of Architecture, Department of Urban and Environmental Planning, Charlottesville, VA, 22904, USA.
[3] Assistant Professor, Universidad San Francisco de Quito USFQ, Colegio de Ciencias e Ingenierías, Departamento de Ingeniería Civil, Casilla Postal 17-1200-841, Quito 170901, Ecuador.

* Correspondence: Miguel Andrés Guerra, MAGuerra@usfq.edu.ec

Abstract

Within education, one of the main challenges is to quantify student learning; Traditional exams are one of the most used methods in construction majors to try to measure the knowledge acquired by students in a specific subject related to the careers of civil engineer and architecture, however the results obtained by these exams can be affected by the stress and anxiety levels of the students at the time of take an exam, reduce performance and prevent a correct quantification of learning. To reduce the stress and anxiety caused by traditional exams in students, and improve their academic performance, the implementation of coffee breaks to the traditional exams is proposed as a possible solution, which implies a break during the exam where students are free to talk to each other and relax in an environment outside the place intended to take the exam. To quantify the impact of the coffee break on the students, surveys were conducted once the coffee break exam was over; the surveys contain questions referring to four stages: days before the exam, and before, during and after the coffee break. The results of the surveys allow us to demonstrate a decrease in the levels of stress and anxiety of the construction majors' students (civil engineering and architecture) at the time of taking the exam with coffee break, improving their performance. The analysis of the results allows us to consider the coffee break as a key element in the development of the exams applied in the academy, improving the evaluation methods in construction majors.

Introduction

One of the main assessment methods in construction majors is the traditional exam. Traditional exams allow to quantify in a certain way if the students have the necessary knowledge to pass the subject they are studying [1]. However, there is substantial evidence in relation to the stress caused by traditional exams, causing a deficient performance of several students and generating complaints after taking the exams, arguing that the stress and worry made their minds unclear, and they forgot the knowledge acquired [2] . In construction majors, exams are mostly taken in the traditional way, that is, individually, with limited time and without the help of notes or didactic material; this being the case in exams at all academic levels [3] Stress occurs not only when students do not remember a concept or are insecure about their knowledge, but also when students have the knowledge

but a state of concern is triggered that prevents correct reasoning and application of the knowledge acquired [4].

The traditional exam evaluation method is applied within engineering and architecture majors throughout university life and throughout the world [5], even though different countries have differences in culture. discipline in engineering[6]–[9]. Academic stress has become a common variable during university life, one of the main triggers being taking and studying for exams[10], [11]. In most of Latin America, two majors are involved in the construction sector, civil engineering and architecture, in fact developing infrastructures require integration of interdisciplinary professionals, and probably, the most important is between architects and civil engineers [12], [13]. Even though architecture uses studio pedagogy for their design courses, most of the other courses throughout their careers assess learning through traditional exams Regardless of the pedagogic approach to teaching, and the various alternatives to traditional exams such as multiple-choice exams, open book exams, longer time for exam development. etc. [14], [15], students feelings toward traditional exams remain similar. It has been shown that high levels of anxiety and stress can have a negative impact on student performance during exams [2]

Although there is research criticizing the efficiency of traditional exams, most courses still use traditional exams as their main assessment method[15]. For this reason, this research project aims to contribute to improve the efficiency of traditional exams by introducing a coffee break during traditional exams. The following section presents an analysis of the implications of a traditional exam on the levels of stress and anxiety in students and how these factors affect the academic performance of construction major students; that even in some cases a bad performance in the exams influence student to dropout the course or the career [16]. Subsequently, the effects of the implementation of exams with coffee break are presented, for the reduction of stress caused by exams in students and how this pilot study can improve academic performance.

Background

Traditional exams are generally exams that contain several questions and exercises on topics taught in a course, which are taken individually, closed book, and during a limited time[17] .The purpose of exams is to assess the course content and knowledge of the students. The most widely used traditional exams are partial or final exams, these represent a high percentage of the final grade for the course and cover various topics [18], due to various factors exams generate feelings of stress and anxiety in students [15]. In addition to traditional exams, courses often have additional assessment methods such as projects or presentations, which have the same purpose as a traditional exam [15].

One of the main factors in traditional exams that generate stress is limited time, resulting in low academic performance [3]. These exams are used because the academic term has extremely limited time schedules. Although time is a trigger for anxiety, increasing time is not an idea supported by researchers [19]–[21]. The idea of increasing time or giving unlimited time is not so accepted because excess time causes uncertainty in students[3]. In the case of most evaluation methods, the level of stress in students increases when they are taking the exam and even in the previous days. It is currently known that stress is a factor

that influence people's performance [22], [23].Stress is a normal feeling in human beings and even on certain occasions it turns out to be necessary, however, when the level of stress is high during exams it turns out to be negative in students, causing low academic performance because it generates effects such as: waste of time on a single question, mental blocks, lack of concentration, etc. [2].

Understanding how students perceive different aspects of their construction careers is important, as it can help us understand how to develop exams that help students become good engineers and architects[24]. There are tools used to encourage students to have a good academic performance, some of them involving stress, such as the fear of failure, where the students generate study habits and preparation for exams. However, this method turns out to be unproductive since not all students react in the same way to work under pressure and stress, generating fear of failure being counterproductive, and causing student performance to be affected[25], even in professional life high stress levels can be managed, because professionals have the opportunity to consult with co-workers, colleagues, design manuals, etc. so as they do not face problems alone. High stress levels can directly affect functions such as memory, concentration, information processing and problem solving [26][27],functions that play a fundamental role when taking an exam.

It has been shown that approximately 60% of students who have high levels of stress do not meet the minimum score on exams, affecting the purpose of the exam [28],alternative methods have been proposed to reduce stress levels, such as: multiple choice tests, increasing test time, open book tests, home tests. Some of these alternative evaluation methods have benefits over traditional exams; since they enhance skills such as critical thinking, reflection, and problem solving, instead of having to focus on the need to memorize as in open book exams [17].In the case of open book exams, as well as the implementation of coffee breaks as an alternative to traditional exams, they minimize stress and anxiety levels and increase the security and confidence of students. Because students have a sense of calm and control of the situation[29].

Another type of evaluation used to reduce stress levels are group exams, which seek to promote cooperation and contrast the knowledge of students within the group. But these exams present problems, since it becomes difficult or impossible to assess the knowledge acquired on an individual basis. Unlike group exams and open book exams, coffee break exams allow students to assess their knowledge individually and more parts of knowledge can be assessed, such as memory, while maintaining critical thinking, reflection and problem solving, keeping stress levels low.

Methodology

The objective of this research is to reduce students stress and improve their exams performance in construction courses by introducing a coffee break during traditional exams. Through this pilot study, the aim is also to reduce stress and anxiety levels before taking the exam, informing students about the break they will have during the test, and during the exam, focusing the analysis in 3 phases: before, during and after the coffee break. The study was conducted with a qualitative approach to measure the performance of civil engineering and architecture students. The data collection was carried out during the first

semester 2022/2023, taught between August and December, in the civil engineering courses: Construction Management (n=18 students) and Construction Cost Engineering (n=16 students), and the Architecture courses: Structures-1 (n=22 students) and Structures-2 (n=21 students), with a total sample size of n=77 full time architecture and civil engineering students between the 4th and 9th semester of their degrees. Surveys were conducted on the students of the participating groups after having taken the exam. The survey contained open questions which had the objective of analyzing the state of mind of the students in the days before the exam, and before, during and after the coffee break.

For data analysis, the surveys were conducted using Qualtrics software and the information was filtered using Excel. The coding of the answers was based on evidencing how the coffee break positively or negatively influenced the mood of the students, reduced the level of stress and increased satisfaction in the performance of the students. The answers were cataloged in three main groups: good, bad, and neutral; and they are grouped by general themes that cover responses in related categories. The questions were divided into four main blocks. The first set of questions were open-ended questions regarding mood and stress level in the days before taking the exam, and how knowing how the 15-minute coffee break affected stress levels, well-being, and concentration to prepare. For the exam. The second set of questions referred to the first 45 minutes of the exam before the coffee break; where I was looking for evidence if the students had any problems concentrating on this subject was facilitated, if they had problems reading the questions, in addition to knowing how they felt in the first part of the exam, knowing that they would eventually go to the coffee break. The third group of questions inquired about the mood and feelings during the coffee break, considering how useful it was to socialize with classmates in the middle of the exam, if it was possible for them to help clarify their classmates' doubts and their own doubts. The fourth and last block of questions refers to how their stress levels were when they returned to the classroom after the coffee break, asking if they were more relaxed, comfortable with their exam development and if they were able to take the exam in a better way. In the same way, the questions sought for students to give their opinion when comparing a traditional exam with the exam with a coffee break.

Two civil engineering courses and two architecture courses took their exam with a coffee break. The exams consisted of six open-ended questions that require critical thinking and represent 40% of the exam grade and three comprehensive problems to solve that were the 60% of the exam grade. The rules for the exam were as follows: students could use a pencil, eraser, pen, ruler, calculator and could have a non-alcoholic drink; these being the materials that they will need to solve the exam. Any other object should be placed in the student's backpack, which should remain closed during the exam. Cell phones were not allowed, and they also had to be turned off and inside the backpack. The rules were explained before the exam began. The time for the exam was divided into three parts. In the first part, the students took the exam for 45 minutes; during this time, the students can read all the questions and exercises and complete the number of questions they want and in the order they want, like a traditional exam. After these 45 minutes, they had a 15-minute break in another room where they had water, juice, coffee, cookies, and chips, take a break from the exam, and they could talk about anything (including the exam), but they could not bring anything from the exam room nor write anything; during the 15 minute coffee break the students were monitored by the teacher and assistants that verify that the exam rules are

met. After the coffee break, they return to the exam room and have 60 minutes to continue and finish the exam [2]. The exam is designed to assess critical thinking and the ability to solve numerical and practical problems, so it is necessary that students have prior knowledge of the subject and be prepared for the exam. In the event that students do not have the necessary knowledge to take the exam, the coffee break will not help them even if during this time they are explained how to solve the exam, since the exam questions cannot be answered by memorizing the answers during the coffee break.

Results

The pilot study allowed us to know fundamental aspects in relation to the performance of the students and the stress caused by the exam. Four phases were analyzed: days before the exam, the first part of the exam, the coffee break, and the last part of the exam. In the initial phase, corresponding to the days prior to the exam, it was seen that the state of mind of the students knowing that the exam included a 15-minute break allowed them to reduce stress; having 49.5% of the students with answers related to that they were calmer and more relaxed, with a good state of mind. Only 15.5% showed anxiety, stress, worry or feeling the same as with a normal exam. The reduction in stress in the students showed that 76% of the students managed to study better since it became easier to study. The stress hours before the exam in the same way managed to stay on minimum scales; 71% of the students affirm that they were calm and calm since they could corroborate the information or clear their minds during the break. A surprising 88.7% of the students surveyed, upon learning about the Coffee break, considered that this could help them during the exam because they felt less pressure, because they could clarify doubts or clear their minds, in addition to the fact that some students commented that the Coffee break helped them to have a better control of time.

During the exam, in the first minutes it was observed that the students had much lower stress levels compared to normal exams, because they had a break and the opportunity to clarify any doubts that arise. 83.5% of the respondents had an exceptionally low level of stress even when reading the question. The students in the first part of the exam managed to remember what was studied better and had no problems concentrating because they were confident and calm; less than 17.5% of the students stated that they had problems with stress or concentrating because they did not remember what they studied. More than 90% of the participants were relieved during the first part of the exam, they also had less stress and more peace of mind knowing that during the coffee break they can solve their doubts or simply rest and clear their minds.

During the Coffee break, almost 94% of the students described that the experience during the 15 minutes was relaxing, useful to clarify doubts and even fun and enjoyable. Only 3% of the students could not help their classmates or discuss the topics because they did not previously understand the exam topics. After the coffee break, 85.6% of the respondents were able to complete the parts of the exam that they could not complete during the first phase of the exam; less than 7% of the students failed to complete the exam after the break due to not understanding. 84.5% of the students who participated in the exam with Coffee break felt a reduction in stress and anxiety in the last 60 minutes of the exam and felt that

they obtained better results compared to a normal exam. Only 4% did not understand the exam and felt frustrated and 3% felt that the exam was the same as a normal exam.

Phase of the Coffee Break Exam	Exam with coffee break	Students' statements regarding the Coffee Break
Days before the exam	State of mind before the exam	I felt calmer and more relaxed because I could clarify doubts during the coffee break
		I feel good and without pressure knowing that I had a break
	Exam preparation	I felt stress reduction knowing that I could talk about the exam during the coffee break
		Better concentration when studying because I had less pressure
First part of the exam	Mood and concentration in the first 45 minutes of the exam	I feel calm and confident, what I cannot remember I was able to clarify during the coffee break
		I was able to concentrate better on what I understood and could clarify what I did not at the coffee break
	Comparison between normal exam and exam with coffee break	The stress level is lower when having a coffee break
		A normal exam stresses me out, while the exam with a coffee break does not.
Coffee break	Experience during the coffee break	I felt calm and relaxed.
		It was a good and extremely useful experience
	Resolve doubts in the coffee break	I was able to clarify doubts and compare answers that I had during the first part of the exam.
		I was able to help my colleagues with the doubts they had.
Post coffee break	Mood after coffee break	I will feel relieved because I resolved the doubts I had.
		I felt good and safe because I saw that I was doing the exam well.
	Efficiency in the last part of the exam	I was able to complete what I was missing because I no longer had doubts.
		I felt much less worried than in a normal exam, because I relaxed during the coffee break and cleared my mind.

Table 1: Students self-report answers about the exam with coffee break.

The students before the exam stated that they had a positive state of mind where they said they felt calmer and more relaxed when they learned that the exam had a coffee break where they could solve their doubts in case, they did not remember something, "I felt more relaxed and less anxious because At the coffee break I had time to reflect on what I did not remember". It is thanks to the coffee break that the days before the exam the students were able to concentrate better and feel calmer" It was easier, since I knew that if I forgot something I could discuss it with." During the first part of the exam, students kept lower

stress levels and their minds remained calm and clear; The coffee break also allowed them to analyze the exam questions in a different way, where they could first solve the questions they knew and during the coffee break they could clarify any doubts with the questions that presented some kind of uncertainty or that they did not remember, as stated by the Most of the students “I felt less pressure and worry, I read all the questions and I was solving the ones I knew, I proceeded to fill out the following ones and so on, the ones I was not sure and had doubts I could clear up with my classmates in a general way”.

In the coffee break phase students felt relieved and that socializing about the exam allowed them to clarify their doubts, in addition to being able to help their classmates with the doubts they had “Do not worry, I was able to help my classmates with some of their doubts, just as they helped me in mine.” Other students took the coffee break time just to take a breather, organize their time better and even eat something and enjoy the moment “I liked the experience because it is a moment of relaxation and I do not think so much about the exam because I also had time to talk about other topics and clear the mind”. Upon returning from break, the students said they felt relieved, not only because they clarified their doubts, but also because they were able to verify that what they had done was correct. In the last part of the exam, they were more efficient and were able to complete the questions, handing in exams to which they felt confident in what they had answered “Very calm and confident in my knowledge compared to other exams that start with tension, stress and at the end of them he comes out with worry and anxiety”. When checking a normal exam with a coffee break exam, students say they feel much calmer and more relaxed when having coffee break, which allows them to take exams in a better way and obtain better results. While a regular exam frustration and stress play a key role and prevent them from completing the exam and demonstrating the acquired knowledge.

Discussion

The stress and pressure of traditional exams affect student performance, so the knowledge acquired becomes difficult be determined. The coffee break seeks to reduce the stress caused by traditional exams. In the study carried out, it was possible to show that many students, by having a break, were able to reduce stress levels and even eliminate anxiety during the first part of the exam because they knew that during the coffee break, they could socialize with their classmates and clear up any doubts they might have. Sun rises first minutes of the exam. In the days before the exam, when studying and preparing to take the exam, stress already begins to arise in students, increasing in the minutes before taking the exam. The knowledge that the exam had a coffee break generated a positive effect; The students felt more relaxed, so they were able to study and prepare better, in addition to remembering the topics to be evaluated more clearly by having a clear and calm mind.

It is important to emphasize that for the coffee break to work, students must be prepared and understand the subject to be evaluated. In very particular cases in which the students did not prepare and did not know how to complete the exam questions, the coffee break did not help them and even the explanations received during the break confused them more. This shows that the break is beneficial only if the students dominate the subject but due to some circumstances, they forget something about the exam. What the coffee break allows is to clarify specific doubts or in some cases confirm that what was done in the exam is

correct; In addition, a way to measure the proficiency that students have on the subject is that they can resolve doubts from other classmates. Most of the students managed to help their classmates and received help; in addition to comparing answers, which generates a state of satisfaction and confidence knowing that they managed to solve the exam correctly.

During the initial stage of the exam, the students seemed calmer. People who showed symptoms of being in a state of frustration or who had anxiety were not perceived; This is because, if any doubt appeared at any point in the exam, the students knew that they could clarify their doubts in the coffee break. In the time allocated for the coffee break, it was appreciated how the students socialized, compared answers, some simply cleared their minds or rested, which made them feel more confident and determined to correctly solve all the questions when they return to the classroom and continue with the exam. The fear of not completing a question, the fear of not knowing if the answer was correct or not, was almost eliminated. This decrease in stress and increase in the feeling of control of the situation is similar to that generated by an open book exam [30]–[32]. Among the responses to the surveys, in addition to showing that stress levels decreased, there were unexpected responses, such as some students who told that the coffee break helps them better control the time to develop the exam, who managed to organize themselves better during the exam. exam or that even eating or just leaving the classroom for a few minutes relaxes them.

The collection and analysis of data provided by the surveys conducted on the construction mayor students make it clearer that these types of exams, compared to traditional exams, manage to reduce stress, before, during and after the tests. From students 'perspective we can affirmed that thanks to the reduction of stress they were able to take a better exam having a positive impact on the academic performance and on their mental and psychological health. For future coffee breaks, an interdisciplinary approach can be made, where psychologists, pedagogical experts, and even doctors participate and allow us to have a better analysis of stress reduction in students, to arrive at better solutions in the academic field and implement them in more courses related to construction majors [9]. A point not considered, which arose in the experimentation, is that it was possible to bring architecture students together with civil engineering students during the coffee break, making them socialize among themselves and managing to eliminate barriers between them. This is important because infrastructure demands architects and civil engineers to converge into an effective workflow [24].

Conclusion

In construction mayor classes, traditional exams are widely used to try to measure the knowledge acquired by students. The performance of students in this type of exam in many cases can be affected by psychological factors, stress, anxiety, etc., negatively influencing the academic performance of students and making the traditional exam unsuitable for measuring the knowledge acquired. The coffee break was presented as a viable alternative to improve student performance in exams, by trying to reduce stress levels before and during the exam. Once the exams were completed, the surveys were carried out and the data was analyzed, it was possible to determine that the students having the coffee break during the exam improved their performance and the level of stress and anxiety was reduced, this is because the students did not generate frustration or fear of failing, since

during the break they were able to resolve their doubts and return to the exam confident and knowing what they had to do to complete the exam successfully. In the cases where the coffee break could not be beneficial, it was in students who were not prepared or had not studied for the exam, since despite receiving information on how to solve the exam, they could not understand this information or put it into practice after the coffee break; Therefore, it is shown that if there is no correct preparation on the part of the students, the help that can be provided in the coffee break becomes almost nil. The study managed to demonstrate that if any modification is made to the traditional exams, these can stop being a trigger for stress in the students, and evaluation methods can be used where the real performance of the students can be seen in a better way. The coffee break can be implemented in traditional exams, which means individual exams, without the help of books or notes, if necessary, the use of a form could be allowed, it is not a method designed for virtual exams.

In the future, it is planned to implement sensors to monitor heart rate and brain responses to stress and how the coffee break affects anxiety levels compared to traditional exams, it is also expected to be able to have a record of the conversations during the coffee break [2]. For future studies, it is sought to analyze the conversations that students have during the coffee break, in order to demonstrate the social interaction of students and their development, it is also sought to see how this methodology helps all types of students, including those that they present problems to associate with their peers due to various reasons and that the coffee break is beneficial for all students equally. It is sought to analyze these data to implement a new pedagogical design for the traditional exams in the future and evaluate it; managing to implement the coffee break in different courses in the field of engineering to broaden the study and create guidelines for the incorporation of exams with coffee break.

References

[1] S. I. Efu, “Exams as learning tools: A comparison of traditional and collaborative assessment in higher education,” *Coll. Teach.*, vol. 67, no. 1, pp. 73–83, 2019.

[2] N. Granja, V. Guerra, and M. A. Guerra, “Give me a coffee break! Pilot study on improving exam performance and reducing student stress,” in *2022 ASEE Annual Conference & Exposition*, 2022.

[3] C. H. Ramming and R. Mosier, “Time Limited Exams: Student Perceptions and Comparison of Their Grades versus Time in Engineering Mechanics: Statics,” in *2018 ASEE Annual Conference & Exposition*, 2018.

[4] N. K. Balaji, P. S. Murthy, D. N. Kumar, and S. Chaudhury, “Perceived stress, anxiety, and coping states in medical and engineering students during examinations,” *Ind. Psychiatry J.*, vol. 28, no. 1, p. 86, 2019.

[5] J. Acosta and M. A. Guerra, “Validating Guerra’s Blended Flexible Learning framework for Engineering Courses,” in *2022 ASEE Annual Conference & Exposition*, 2022.

[6] M. A. Guerra, H. Murzi, J. C. Woods Jr, and A. Diaz-Strandberg, “Understanding Students’ perceptions of Dimensions of Engineering Culture in Ecuador,” in *2020 ASEE Virtual Annual Conference Content Access*, 2020.

[7] H. Murzi *et al.*, "Cultural dimensions in academic disciplines, a comparison between Ecuador and the United States of America," in *2021 ASEE Virtual Annual Conference Content Access*, 2021.
[8] M. A. Guerra and C. Gopaul, "IEEE Region 9 Initiatives: Supporting Engineering Education During COVID-19 Times," *IEEE Potentials*, vol. 40, no. 2, pp. 19–24, Mar. 2021, doi: 10.1109/MPOT.2020.3043738.
[9] H. Velásquez, M. Guerra, and M. Jimenez, "Exploring Interdisciplinary Contributions to More Sustainable Solutions in the Built Environment and Infrastructure Development Students," in *2022 ASEE Annual Conference & Exposition*, 2022.
[10] K. J. Cross and K. J. Jensen, "Work in Progress: Understanding Student Perceptions of Stress as part of Engineering Culture," *Am. Soc. Eng. Educ. Conf. Proc.*, Jan. 2018, Accessed: Feb. 11, 2023. [Online]. Available: https://par.nsf.gov/biblio/10058680-work-progress-understanding-student-perceptions-stress-part-engineering-culture
[11] R. Abouserie, "Sources and levels of stress in relation to locus of control and self esteem in university students," *Educ. Psychol.*, vol. 14, no. 3, pp. 323–330, 1994.
[12] C. Ubidia, M. Guerra, V. Guerra, and C. Gallardo, "Work in Progress: Collaborative Environments in Architecture and Civil Engineering Education–Case Study," in *2022 ASEE Annual Conference & Exposition*, 2022.
[13] M. Guerra and T. Shealy, "Teaching user-centered design for more sustainable infrastructure through role-play and experiential learning," *J. Prof. Issues Eng. Educ. Pract.*, vol. 144, no. 4, p. 05018016, 2018.
[14] D. Parsons, "Is there an alternative to exams? Examination stress in engineering courses," *Int. J. Eng. Educ.*, vol. 24, no. 6, pp. 1111–1118, 2008.
[15] A. M. Parker, E. Watson, N. Dyck, and J. P. Carey, "Traditional versus open-book exams in remote course delivery: a narrative review of the literature," *Proc. Can. Eng. Educ. Assoc. CEEA*, 2021.
[16] M. Mariño, C. Ubidia, M. Guerra, and F. Jativa, "WIP: Designing a First-Year Hands-on Civil Engineering Course to Reduce Students Dropout and Improve the Overall College Experience," in *2022 ASEE Annual Conference & Exposition*, 2022.
[17] L. Suskie, *Assessing student learning: A common sense guide*. John Wiley & Sons, 2018.
[18] R. O. Mines Jr, "The impact of testing frequency and final exams on student performance," in *Proceedings of the ASEE Southeastern Section Annual Conference, March*, 2014.
[19] H. Duncan and C. Purcell, "Consensus or contradiction? A review of the current research into the impact of granting extra time in exams to students with specific learning difficulties (SpLD)," *J. Furth. High. Educ.*, vol. 44, no. 4, pp. 439–453, 2020.
[20] H. M. Matusovich *et al.*, "Student outcomes from the collective design and delivery of culturally relevant engineering outreach curricula in rural and Appalachian middle schools," *IJEE Int. J. Eng. Educ.*, vol. 37, no. 4, 2021.
[21] P. R. Brown, R. E. McCord, H. M. Matusovich, and R. L. Kajfez, "The use of motivation theory in engineering education research: a systematic review of literature," *Eur. J. Eng. Educ.*, vol. 40, no. 2, pp. 186–205, 2015.
[22] F. Gonçalves, D. Carneiro, P. Novais, and J. Pêgo, "Eustress: A human behaviour analysis system for monitoring and assessing stress during exams," *Intell. Distrib. Comput. XI*, pp. 137–147, 2018.

[23] M. Guerra and Y. Abebe, “Pairwise elicitation for a decision support framework to develop a flood risk response plan,” *ASCE-ASME J Risk Uncert Engrg Sys Part B Mech Engrg*, vol. 5, no. 1, 2019.
[24] C. Ubidia, M. Guerra, and H. Murzi, “Understanding Student’s Perceptions of Cultural Dimensions in construction majors: Deconstructing barriers between architecture and civil engineering students,” in *2022 ASEE Annual Conference & Exposition*, 2022.
[25] L. Zinkiewicz, N. Hammond, and A. Trapp, “Applying Psychology Disciplinary Knowledge,” 2003.
[26] K. F. Halamandaris and K. G. Power, “Individual differences, social support and coping with the examination stress: A study of the psychosocial and academic adjustment of first year home students,” *Personal. Individ. Differ.*, vol. 26, no. 4, pp. 665–685, 1999.
[27] J. S. Hegenauer, “Stress, depression, and anxiety in undergraduate engineering and architecture students,” in *American Society for Engineering Education Northeast Section Conference, University of Hartford, Hartford, CT*, 2018, pp. 27–28.
[28] M. S. Chapell *et al.*, “Test anxiety and academic performance in undergraduate and graduate students.,” *J. Educ. Psychol.*, vol. 97, no. 2, p. 268, 2005.
[29] L. Myyry and T. Joutsenvirta, “Open-book, open-web online examinations: Developing examination practices to support university students’ learning and self-efficacy,” *Act. Learn. High. Educ.*, vol. 16, no. 2, pp. 119–132, 2015.
[30] T. Ringeisen, S. Lichtenfeld, S. Becker, and N. Minkley, “Stress experience and performance during an oral exam: the role of self-efficacy, threat appraisals, anxiety, and cortisol,” *Anxiety Stress Coping*, vol. 32, no. 1, pp. 50–66, 2019.
[31] M. S. Umuzdas, H. Tök, and S. Umuzdas, “An Examination of the Performance Anxiety Levels of Undergraduate Music Teaching Students in the Instrument Exams According to Various Variables (‘ Case of Tokat Province’).,” *Int. J. High. Educ.*, vol. 8, no. 4, pp. 221–230, 2019.
[32] H. Yusefzadeh, J. Amirzadeh Iranagh, and B. Nabilou, “The effect of study preparation on test anxiety and performance: a quasi-experimental study,” *Adv. Med. Educ. Pract.*, pp. 245–251, 2019.