

## EXAMINING THE EFFECTS OF VIRTUAL CLASSROOM USE INSIDE LEARNING MANAGEMENT SYSTEMS ON ENHANCING STUDENT SATISFACTION

Abdallah Ibrahim Mohammed Elfeky<sup>1</sup> and Marwa Yasien Helmy Elbyaly<sup>2</sup>

<sup>1</sup>Department of Curriculum and Instruction, College of Education, Najran University, Najran, Saudi Arabia

<sup>2</sup>Centre for Sharia, Educational and Humanities Research, Najran University, Najran, Saudi Arabia

[abdalah.elfeqi@spe.kfs.edu.eg](mailto:abdalah.elfeqi@spe.kfs.edu.eg)<sup>1</sup> and [Marwa.mohamed1@spe.kfs.edu.eg](mailto:Marwa.mohamed1@spe.kfs.edu.eg)<sup>2</sup>

### ABSTRACT

*The use of virtual classrooms within learning management systems is on the rise in higher education institutions during times of disaster. The aim of this study is to explore the effects of using virtual classrooms within learning management systems in enhancing learners' satisfaction. The research sample consisted of vocational master's students (the third level) after dividing them into two experimental groups, one for girls and the other for boys. Whereas, both experimental groups studied the "Special Needs Education Techniques" course through virtual classrooms within the Blackboard learning management system. The student satisfaction questionnaire was used as a tool for the current study to achieve the objective of the study. The results showed that there are no significant differences in the use of virtual classrooms within the learning management systems in developing learners' satisfaction with the Special Needs Education Techniques course.*

*Keywords: learning management systems; virtual classes; black board; student satisfaction; Special needs education techniques*

### INTRODUCTION

Virtual classrooms are a common technology in the current global context (Ahmed, Alharbi, & Elfeky, 2022; Sultana, Jibon, & Kashem, 2020). The virtual classroom is a product of technology (Ahmed et al., 2022; Asadi, Khodabandeh, & Yekta, 2019), as it is an electronic learning environment that is easily accessible via the Internet at an affordable price, and this environment is flexible (Masada, 2017). It features an interactive learning environment that features audio and video broadcasts and discussion boards (A. I. M. Elfeky & Elbyaly, 2019; Ruthotto, Kreth, Stevens, Trively, & Melkers, 2020). It is a class that enables students to attend from different locations, overcoming the restrictions of place, and by recording the lecture, students can view it from different times, overcoming the restrictions of time, and for this reason it is called an assumption (Hussain Al-Qahtani, 2019). Besides, online learning through virtual classrooms can be an alternative to traditional learning so that learning activities can continue during the COVID-19 pandemic (M. Y. H. Elbyaly & Elfeky, 2022b; Nahdi & Jatisunda, 2020). The virtual classroom provides an interactive learning environment by integrating Internet technology where students and faculty members can collaborate, interact, explain their ideas, and communicate in well-

structured pedagogical and technical procedures (A. I. M. Elfeky & M. Y. H. Elbyaly, 2021; Sultana et al., 2020).

Many previous studies dealt with virtual classrooms with research and experimentation, including the study of (Asadi et al., 2019; A. I. M. Elfeky, Alharbi, & Ahmed, 2022), which compared a virtual classroom with a traditional classroom according to undergraduate English language students. The results showed that the students who engaged in the virtual class were better than their colleagues who studied in the traditional class, and the virtual class allowed more interaction between the faculty member and the students. Meanwhile, a Learning Management Systems (LMS) includes the application of internet-based software and technologies that are used by faculty and learners to either access, plan, implement, supplement, monitor and evaluate learning, or to communicate about learning (Almalki & Elfeky, 2022; M. Y. H. Elbyaly & Elfeky, 2022a). There are many types of learning management systems, including Moodle, Canvas, and Blackboard, all of which have become essential components in implementing the learning process (AlJarrah, Thomas, & Shehab, 2018; Elbyaly & Elfeky, 2023a, 2023b). The LMS has also become a tool for creating, distributing, tracking and managing different types of training and educational materials (Alharbi, Elfeky, & Ahmed, 2022; Masadeh & Elfeky, 2016). It is frequently utilized in higher education and serve as a doorway to teaching and learning that are facilitated by cutting-edge technology (Sinclair & Aho, 2018). The Blackboard system allows presenting course content, providing synchronous conversations and asynchronous discussions, presenting online tests, recording and summarizing grades, providing schedule and calendar reminders, and handling multimedia files (such as images, sounds, flash presentations, and video clips (Elfeky, 2017).

In addition, student satisfaction with the educational service provided by an educational institution is the sense that the student feels that the educational institution meets some of his desires, goals, or needs, and that this achievement is satisfactory for him (Efrat-Triester, Altman, Friedmann, Margalit, & Teodorescu, 2021). Student satisfaction is also widely used as an indicator of successful learning (Geier, 2021). Satisfaction is widely accepted as a key measure of educational service quality and success in online learning, which receives the most attention from university education institutions seeking competitive advantages (Elfeky & Elbyaly, 2023; García-Murillo, Novoa-Hernández, & Rodríguez, 2020; Santos, Marques, Justino, & Mendes, 2020). Moreover, research has shown that students who are highly satisfied achieve many positive outcomes in their studies, and scientific evidence has shown the impact of student satisfaction on the teaching and learning processes (Elfeky & Elbyaly, 2017; Freire & Ferreira, 2020; Granero-Gallegos, Baños, Baena-Extremera, & Martínez-Molina, 2020; Peng et al., 2021). However, little is also known about whether virtual classrooms within learning management systems may be effective in enhancing student satisfaction (both girls and boys). Therefore, this study seeks to address these gaps by using the Collaborate Ultra Experience LTI virtual classroom environment (as additional to the Blackboard system) in this research to explore the effects on learners' satisfaction.

The problem of the current research emerged through the researchers' observation of a shortcoming in achieving the objectives of the course "Techniques of Teaching Special Needs" among a large

percentage of male and female students of the College of Education. Research has also shown that students, who are highly satisfied, have outcomes that are more positive in their studies. Scientific evidence showed the impact of student satisfaction on the teaching and learning processes (Elfeky & Elbyaly, 2016; Freire & Ferreira, 2020; Granero-Gallegos et al., 2020; Peng et al., 2021). However, little is known about whether virtual classrooms within learning management systems are effective in enhancing satisfaction across groups of learners. Accordingly, the current research problem can be formulated in an attempt to identify the impact of using virtual classrooms within learning management systems on the development of learners' satisfaction (girls and boys).

### **Research Importance**

- Employing additions and features in learning management systems in a way that contributes to achieving the objectives of educational courses.
- Directing attention towards the use of virtual classrooms within learning management systems when relying on these systems in university education.
- Enhancing the satisfaction of learners (girls and boys) in the course "Techniques of Teaching Special Needs".

### **RESEARCH LIMITS**

#### **Objective Determinants**

This research is limited to exploring the effect of using virtual classrooms within learning management systems on enhancing learners' satisfaction in the "Special Needs Education Techniques" course for male and female students of the College of Education, where the Collaborate Ultra Experience LTI application was used, which is provided within the Blackboard system.

#### Human determinants

The sample of this research is limited to male and female students of the College of Education - Najran University.

#### Temporal determinants

The time limits are the first semester of 2023.

#### Spatial determinants

The spatial determinants of the research were represented in the College of Education at Najran University.

### **Research Terms**

#### **Virtual Classes**

An educational electronic environment based on physical separation between male and female students and teachers, by providing a different educational electronic experience characterized by the use of live audio and video broadcasting, the whiteboard, file and application sharing, chat

room, simultaneous internet browsing, and feedback (Alzahrani, Alshammary, & Alhalafawy, 2022; Elbyaly, 2016).

### Learning Management System

An LMS is a tool for creating, distributing, tracking and managing various types of training and educational materials. It is frequently employed in higher education and serve as a doorway to teaching and learning that have been improved by cutting-edge technology (Alshammary & Alhalafawy, 2023; Elbyaly & El-Fawakhry, 2016; Najmi, Alhalafawy, & Zaki, 2023). It is procedurally defined in this research as the Blackboard Learning Management System, which enables the delivery of "Special Education Techniques" course content, the provision of synchronous conversations and asynchronous discussions, the delivery of online tests, the recording and summarization of grades, the provision of schedule and calendar reminders, and the handling of multimedia files. (such as images, sounds, flash shows, and video clips).

### Student satisfaction

Student satisfaction is an expression of the quality of their learning experience and is widely used as an indicator of successful learning (Efrat-Triester et al., 2021). It is defined procedurally in this research as an expression of the quality of students' learning experience associated with the use of virtual classrooms within the Blackboard learning management system.

## METHODOLOGY

The research methodology was to use the experimental approach (with quasi-experimental designs), which aims to know the effect of an independent variable (virtual classrooms within the Blackboard system) on the dependent variable(s) (learners' satisfaction). As a result, the semi-experimental design known as the pre-post design was used using two experimental groups.

**Table (1):** Research Design

	<b>Pre-test</b>	<b>Treatment</b>	<b>Post-test</b>
First experimental group (girls)	satisfaction questionnaire	Virtual classes within the Blackboard system	satisfaction questionnaire
Second experimental group (boys)			

### Research tool (Satisfaction Questionnaire)

To design the student satisfaction questionnaire, the two researchers also looked at previous studies and educational literature that dealt with measuring student satisfaction, such as Alanzi and Alhalafawy (2022); Alzahrani and Alhalafawy (2022); Choe et al. (2019); Napitupulu et al. (2018); Razinkina et al. (2018); Van Griethuijsen, Kunst, van Woerkom, Wesselink, and Poell (2020). The student satisfaction questionnaire consisted of (30) statements, half of which were positive and the other half negative. When preparing the questionnaire, it was taken into account to exclude phrases

that could be interpreted in more than one way, that the phrases contain the topic of satisfaction, explicitly or implicitly, and that the phrases are free from ambiguity. A five-like Likert scale was used (from 5=strongly agree to 1=strongly disagree) for each positive statement, and the opposite for negative statements.

It also necessitated ensuring the validity of the questionnaire by presenting it in its initial form to a group of specialists in the field of educational technologies, home economics, and curricula and teaching methods. Where the arbitrators were asked to express their opinions in the students' satisfaction questionnaire in terms of the appropriateness of the phrases, their clarity and the soundness of their linguistic formulation, and what can be deleted or added from those phrases, and any other suggestions or observations. The unanimity of (80%) of the opinions of the arbitrators was also sufficient to accept each statement of the questionnaire, and the observations made by the men of the arbitrators were taken into account when final preparation of the student satisfaction questionnaire.

Verifying the stability of the student satisfaction questionnaire required the use of Cronbach's alpha coefficient for the consistency of the internal statements, by applying the scale to a reconnaissance sample of (10) male and female students not included in the actual research, and the value of the stability coefficient for the scale was (0.85). By recording the time taken by each male and female student from the survey sample to answer the questionnaire, and calculating the average time, it becomes clear that the time required to implement the questionnaire is (28) minutes. Thus, the questionnaire is ready to be applied to male and female students, the research sample.

## RESEARCH SAMPLE

The final research sample consisted of (60) female and male students in the third level of the Master of Vocational Education Technologies during the first semester 2023, after dividing them into two equal groups, each consisting of (30) female students for the first group and male for the second. Both of them also studied the course "Technologies for Teaching Special Needs" via the Collaborate Ultra Experience LTI virtual classroom, which is provided within the Blackboard e-learning management system. The following steps explain how to verify the homogeneity of the two groups in the student satisfaction questionnaire:

### Ensure That the Two Groups are Equal in Student Satisfaction

The application of the student satisfaction questionnaire also beforehand to all male and female students in the research sample. In addition, by analyzing the extracted data as well with T. test for independent samples to identify the significance of the differences between the mean scores of the two research groups to verify their equivalence before the start of the experiment. Table (2) reveals the differences between the scores of male and female students in the pre-application using the student satisfaction questionnaire.

**Table 2.** Significance of differences between the two research groups in the pre-measurement of the student satisfaction questionnaire

Group	N	M	SD	Mean Difference	T. Ratio	Sig.
First experimental group (girls)	30	78.54	5.199	1.72	3.621	0.419
Second experimental group (boys)	30	76.82	4.627			

It is clear from the previous table the differences between the mean scores of the two research groups in the pre-application of the student satisfaction questionnaire, as it was not statistically significant at the level (0.05). That is, the male and female students in the research sample were homogeneous in the level of satisfaction before exposure to the experiment.

### Experimental Processing Material

To present the content of the "Special Needs Education Technologies" course through virtual classrooms (the Collaborate Ultra Experience LTI application integrated into the Blackboard learning management system was used). The course content was organized into (11) lectures to present the educational material. This is after referring to a number of educational design models to come up with procedural steps to guide them in the design and production of lectures presented to achieve the research objectives. This is in terms of defining objectives, content and designing activities according to the characteristics of the learners. The lectures were presented to both experimental groups (boys and girls) through virtual classrooms, taking advantage of the capabilities provided by the virtual classroom application, which are live video and audio broadcasts, chat room, application or desktop sharing, whiteboard, and synchronous browsing of the web.

### RESULTS

In order to answer the research question, by extracting the arithmetic mean scores for the post application of the student satisfaction questionnaire for both research groups, in order to also try to find out if there are statistically significant differences between the two experimental groups in satisfaction due to the learner's gender factor. Table (3) shows the results of the T. test to compare the average satisfaction scores of the two experimental research groups.

**Table.3.** Results of the T. test to compare the mean scores of satisfaction for the two experimental research groups

Group	M	SD	Mean Difference	T. Ratio	Sig.
First experimental group (girls)	132.47	4.483	2.73	5.194	0.375
Second experimental group (boys)	135.20	5.397			

The previous table shows that the averages of the two experimental groups are high. This indicates the development of satisfaction between both groups of boys and girls because of the use of virtual classrooms within learning management systems. The previous table also shows that the (T) value of the difference between the scores of the two experimental research groups (the boys' group and the girls' group) in satisfaction amounted to (5.194). The average score of the students of the first experimental group was (132.47). The average score of the students of the second experimental group was (135.20). That is, there are no statistically significant differences ( $p = 0.375 > 0.05$ ) between the two groups of boys and girls with regard to satisfaction. Thus, we can say that this result indicates that there are no statistically significant differences as a result of the use of virtual classrooms within learning management systems on the development of motivation and satisfaction of students (boys and girls), and thus we have answered the research question.

## DISCUSSION

This study was conducted to explore the effects of using virtual classrooms within learning management systems in enhancing the satisfaction of learners enrolled in the "Special Needs Education Techniques" course within the professional master's program. These results showed that the use of virtual classrooms within the Blackboard learning management system had an impact on the development of satisfaction among students in both groups. The results also showed that there were no significant differences between the two study groups (girls and boys) in satisfaction because of the use of virtual classrooms within learning management systems. This result is consistent with a number of previous studies, including what was revealed by Manal Hussain Al-Qahtani (2019) that the use of virtual classes enhanced communication skills, and (Elfeky & Elbyaly, 2021) also confirmed the effectiveness of virtual classes compared to the traditional method in terms of developing English language proficiency. Which appeared through the result of the achievement test of the English language.

## RECOMMENDATIONS

- Training male and female faculty members on the skills of employing virtual classrooms in learning management systems.
- Using other technical products to develop academic motivation and student satisfaction.
- Paying attention to the development of academic motivation at different educational levels.

## SUGGESTED RESEARCH

- Conducting similar studies at the undergraduate level, to confirm the success of using virtual classrooms within learning management systems in other environments.
- Conducting further studies to explore the possibility of enhancing student satisfaction with augmented reality.
- Conducting studies to reveal the impact of using the project method on enhancing male and female students' satisfaction.

## ACKNOWLEDGMENT

The authors are thankful to the Deanship of Scientific Research at Najran University for funding this work, under the General Research Funding program grant code (NU/NRP/SEHRC/12/15).

## REFERENCES

- Ahmed, E. S. A. H., Alharbi, S. M., & Elfeky, A. I. (2022). Effectiveness Of A Proposed Training Program In Developing Twenty-First Century Skills And Creative Teaching Skills Among Female Student Teachers, Specializing In Early Childhood. *Journal of Positive School Psychology*, 4316-4330.
- Alanzi, N. S. A., & Alhalafawy, W. S. (2022). A Proposed Model for Employing Digital Platforms in Developing the Motivation for Achievement Among Students of Higher Education During Emergencies. *Journal of Positive School Psychology*, 6(9), 4921-4933.
- Alharbi, S. M., Elfeky, A. I., & Ahmed, E. S. (2022). The effect of e-collaborative learning environment on development of critical thinking and higher order thinking skills. *Journal of Positive School Psychology*, 6848-6854.
- AlJarrah, A., Thomas, M. K., & Shehab, M. (2018). Investigating temporal access in a flipped classroom: procrastination persists. *International Journal of Educational Technology in Higher Education*, 15(1), 1-18.
- Almalki, A. D. A., & Elfeky, A. I. M. (2022). The Effect of Immediate and Delayed Feedback in Virtual Classes on Mathematics Students' Higher Order Thinking Skills. *Journal of Positive School Psychology*, 432-440-432-440.
- Alshammary, F. M., & Alhalafawy, W. S. (2023). Digital Platforms and the Improvement of Learning Outcomes: Evidence Extracted from Meta-Analysis. *Sustainability*, 15(2), 1305.
- Alzahrani, F. K. J., & Alhalafawy, W. S. (2022). Benefits And Challenges Of Using Gamification Across Distance Learning Platforms At Higher Education: A Systematic Review Of Research Studies Published During The COVID-19 Pandemic. *Journal of Positive School Psychology*, 6(10), 1948-1977.
- Alzahrani, F. K. J., Alshammary, F., & Alhalafawy, W. (2022). Gamified Platforms: The Impact of Digital Incentives on Engagement in Learning During Covide-19 Pandemic. *Cult. Manag. Sci. Educ*, 7, 75-87.
- Asadi, N., Khodabandeh, F., & Yekta, R. R. (2019). Comparing and contrasting the interactional performance of teachers and students in traditional and virtual classrooms of advanced writing course in distance education university. *Turkish Online Journal of Distance Education*, 20(4), 135-148.
- Choe, R. C., Scuric, Z., Eshkol, E., Cruser, S., Arndt, A., Cox, R., . . . Barnes, G. (2019). Student satisfaction and learning outcomes in asynchronous online lecture videos. *CBE—Life Sciences Education*, 18(4), ar55.

- Efrat-Triester, D., Altman, D., Friedmann, E., Margalit, D. L.-A., & Teodorescu, K. (2021). Exploring the usefulness of medical clowns in elevating satisfaction and reducing aggressive tendencies in pediatric and adult hospital wards. *BMC health services research*, 21(1), 1-14.
- Elbyaly. (2016). Heritage Revival by the Use of Saudi Bedouin Textiles in the Gulf Mantle. *Journal of Home Economics*, 26(4).
- Elbyaly, & El-Fawakhry. (2016). Online teaching course to develop STUDENTS' CREATIVITY in handmade embroidery. *British Journal of Education*, 4(13), 30-51.
- Elbyaly, & Elfeky. (2023a). The effectiveness of a program based on augmented reality on enhancing the skills of solving complex problems among students of the Optimal Investment Diploma. *Annals of Forest Research*, 66(1), 1595-1606.
- Elbyaly, & Elfeky. (2023b). The effectiveness of project-based learning on enhancing the critical thinking skills of optimal investment students. *Annals of Forest Research*, 66(1), 1569-1583.
- Elbyaly, M. Y. H., & Elfeky, A. I. M. (2022a). Investigating the effect of vodcast to enhance the skills of the Canadian smocking and complex problem solving. *Current Psychology*, 41(11), 8010-8020.
- Elbyaly, M. Y. H., & Elfeky, A. I. M. (2022b). The role of metacognition in promoting deep learning in MOOCs during COVID-19 pandemic. *PeerJ Computer Science*, 8, e945.
- Elfeky. (2017). Social Networks Impact factor on Students' Achievements and Attitudes towards the "Computer in Teaching" Course at the College of Education. *International journal on E-learning*, 16(3), 231-244.
- Elfeky, & Elbyaly. (2016). The impact of learning object repository (lor) in the development of pattern making skills of home economics students. *British Journal of Education*, 4(2), 87-99.
- Elfeky, & Elbyaly. (2017). The use of CSCL environment to promote students' achievement and skills in handmade embroidery. *European Journal of Training and Development Studies*, 4(2), 19-32.
- Elfeky, & Elbyaly. (2021). Developing skills of fashion design by augmented reality technology in higher education. *Interactive Learning Environments*, 29(1), 17-32.
- Elfeky, & Elbyaly. (2023). The impact of augmented reality technology on developing hand embroidery skills among students of the College of Education. *Annals of Forest Research*, 66(1), 1584-1594.
- Elfeky, A. I. M., Alharbi, S. M., & Ahmed, E. S. A. H. (2022). The Effect Of Project-Based Learning In Enhancing Creativity And Skills Of Arts Among Kindergarten Student Teachers. *Journal of Positive School Psychology*, 6(8), 2182-2191.
- Elfeky, A. I. M., & Elbyaly, M. Y. H. (2019). Multimedia: Different Processes. *Interactive Multimedia-Multimedia Production and Digital Storytelling*.

- Elfeky, A. I. M., & Elbyaly, M. Y. H. (2021). The use of data analytics technique in learning management system to develop fashion design skills and technology acceptance. *Interactive Learning Environments*, 1-18.
- Freire, T., & Ferreira, G. (2020). Do I need to be positive to be happy? Considering the role of self-esteem, life satisfaction, and psychological distress in Portuguese adolescents' subjective happiness. *Psychological reports*, 123(4), 1064-1082.
- García-Murillo, G., Novoa-Hernández, P., & Rodríguez, R. S. (2020). Technological Satisfaction About Moodle in Higher Education—A Meta-Analysis. *IEEE Revista Iberoamericana de Tecnologías del Aprendizaje*, 15(4), 281-290.
- Geier, M. T. (2021). Students' expectations and students' satisfaction: The mediating role of excellent teacher behaviors. *Teaching of Psychology*, 48(1), 9-17.
- Granero-Gallegos, A., Baños, R., Baena-Extremera, A., & Martínez-Molina, M. (2020). Analysis of misbehaviors and satisfaction with school in secondary education according to student gender and teaching competence. *Frontiers in psychology*, 11, 63.
- Hussain Al-Qahtani, M. (2019). Teachers' and students' perceptions of virtual classes and the effectiveness of virtual classes in enhancing communication skills. *Arab World English Journal (AWEJ) Special Issue: The Dynamics of EFL in Saudi Arabia*.
- Masada, T. S. Y. (2017). Immediate versus delayed feedback in promoting student teachers skills for lesson plan implementation. *Thouqan Saleem Yakoub Masadeh and Abdellah Ibrahim Mohammed Elfeky (2017) Immediate Versus Delayed Feedback in Promoting Student Teachers Skills for Lesson Plan Implementation, British Journal of Education*, 5(8), 43-58.
- Masadeh, T. S. Y., & Elfeky, A. I. M. (2016). Efficacy of open-source learning management systems in developing the teaching skills of English language student teachers. *American Journal of Educational Research*, 4(4), 329-337.
- Nahdi, D. S., & Jatisunda, M. G. (2020). Analisis literasi digital calon guru SD dalam pembelajaran berbasis virtual classroom di masa pandemi covid-19. *Jurnal Cakrawala Pendas*, 6(2).
- Najmi, A. H., Alhalafawy, W. S., & Zaki, M. Z. T. (2023). Developing a Sustainable Environment Based on Augmented Reality to Educate Adolescents about the Dangers of Electronic Gaming Addiction. *Sustainability*, 15(4), 3185.
- Napitupulu, D., Rahim, R., Abdullah, D., Setiawan, M. I., Abdillah, L. A., Ahmar, A. S., . . . Pranolo, A. (2018). Analysis of student satisfaction toward quality of service facility. Paper presented at the *Journal of Physics: Conference Series*.
- Peng, C., Yuan, G., Mao, Y., Wang, X., Ma, J., & Bonaiuto, M. (2021). Expanding Social, Psychological, and Physical Indicators of Urbanites' Life Satisfaction toward Residential Community: A Structural Equation Modeling Analysis. *International Journal of Environmental Research and Public Health*, 18(1), 4.

Razinkina, E., Pankova, L., Trostinskaya, I., Pozdeeva, E., Evseeva, L., & Tanova, A. (2018). Student satisfaction as an element of education quality monitoring in innovative higher education institution. Paper presented at the E3S Web of Conferences.

Ruthotto, I., Kreth, Q., Stevens, J., Trively, C., & Melkers, J. (2020). Lurking and participation in the virtual classroom: The effects of gender, race, and age among graduate students in computer science. *Computers & Education*, 151, 103854.

Santos, G., Marques, C. S., Justino, E., & Mendes, L. (2020). Understanding social responsibility's influence on service quality and student satisfaction in higher education. *Journal of cleaner production*, 256, 120597.

Sinclair, J., & Aho, A.-M. (2018). Experts on super innovators: understanding staff adoption of learning management systems. *Higher Education Research & Development*, 37(1), 158-172.

Sultana, M., Jibon, F. A., & Kashem, M. A. (2020). An Improved Model of Virtual Classroom using Information Fusion and NS-DBSCAN. *Global Journal of Computer Science and Technology*, 20(5).

Van Griethuijsen, R. A., Kunst, E. M., van Woerkom, M., Wesselink, R., & Poell, R. F. (2020). Does implementation of competence-based education mediate the impact of team learning on student satisfaction? *Journal of Vocational Education & Training*, 72(4), 516-535.