Unlocking Success: Exploring the Link between Perceived Learning, Academic Engagement, and Performance in Chat GPT among EFL Students at Qassim University

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Abstract

The aim set for this study was to investigate the impact of cognitive, emotional, and behavioural academic engagement on the perception regarding learning and academic performance held by students learning English as Foreign Language (EFL) at Qassim University in the Kingdom of Saudi Arabia. In other words, the research set about examining in precise manner the correlation among these three forms of involvement – in academic engagement: (i) cognitive; (ii) emotional; and (iii) behavioural. Perception regarding learning and academic performance held by EFL learning students has been examined. As many as 301 students selected as participants in the investigation. The structural equation modeling paradigm was used during the investigation to examine the correlations among these variables. The model and data display a strong fit, as shown by the following values: Comparative Fit Index (0.891), Tucker-Lewis Index (0.944), Root Mean Square Error of Approximation (0.041), and Standardized Root Mean Square Residual (0.059). Intellectual and emotional participation of participants significantly reported progress as: ($\beta = 0.482$, $p < 0.01$), whereas behavioural engagement did not come out significant ($\beta = 0.031$, $p = 0.856$). Psychological participation ($\beta = 0.405$, $p < 0.01$) has a substantial correlation with academic success, but emotional and cognitive involvement ($\beta = -0.176$, $p = 0.298$ and ($\beta = 0.004$, $p = 0.982$) did not have correlation. It was noticed, therefore, that more effective engagement approaches were needed to improve virtual education learning and performance.

Keywords: Academic success, perception, cognitive, emotional and behavioural engagement, development, digital, higher education, involvement.

Introduction

The COVID-19 epidemic forced school-closures globally for almost 1.6 billion children as per revelation made in the study report turned over by Gonzalez et al (2020); Hodges (2020); and UNESCO (2021). As scare of epidemic and care regulations suggested by medical authorities/personnel and WHO issuing guidelines to restrict and fight the demonic epidemic, and enforced by authorities in all countries, this was unusual transition and recourse to emergency online learning which occurred without planning or definite regulations, presented formidable challenges for students, educators and governments alike discomfort, inconvenience and panic. There was no time to regulate, plan and make suitable arrangements. As per researchers namely Adedoyin & Soykan (2020); Aguilera-Hermida (2020); and Hazaea et al (2021), the developing countries faced additional challenges due to limited technology, no or little internet connectivity, and resource-crunch.

Literature Review

There is great difference between online classes and traditional classrooms. The former classes are virtual and the latter offline (physical). In the opinion of Dhawan (2020), Delivery of Internet-aided education allows for resource access at any time and place (benefits). On the other hand, Hodges et al (2020) say that despite these benefits, the educators experienced the difficulty of maintaining required high level of educational quality and student-participation during this period of fast transformation. Ali (2020); and Gonzalez et al (2020) agree with preceding authors namely Hodges et al (2020) and give their view that in response to the epidemic, numerous higher education institutions had transitioned to virtual teaching to uphold social distancing measures enforced by the authorities. A study made by Gonzalez et al (2020) made an indication to the effect that emergency e-learning prioritized timely and reliable transmission over replicating the entire educational experience.

Virtual platforms sprang up like mushroom-growth and in no time embraced popularity and eminence as mode/method of teaching at colleges worldwide including South America and the Middle East not only during the entire period of epidemic but also these continued to be used in some colleges and countries.

In the opinion of Aucejo et al (2020), there were many people who started realizing that hybrid or fully online learning models might survive the epidemic. This is despite many schools reverting to face-to-face instruction. In spite of this, Muthuprasad et al (2021) say that there are doubts in the minds of educators and others over whether or not online learning can sufficiently fulfill or achieve the essential learning objectives, especially in social settings where digital literacy is poor.

Besser et al (2020); and Tadesse & Muluye (2020) state on the basis of findings of their studies that university students in all corners of the world had having a tough time adjusting to these new learning settings, which often resulted in decline in academic engagement and performance.

According to the study findings in the report produced by Cai et al (2022), a number of students had difficulty in maintaining their interest and involvement in virtual classrooms, which is a crucial factor in determining academic achievement. According to Martin and Bolliger (2022), academic engagement, which may be described as the active involvement and investment of students in their academic work, is an essential component in the process of obtaining the intended educational results. Wang et al (2021) said that this involvement encompasses many dimensions, including cognitive, emotional, and behavioural aspects, all of which contribute to successful learning results.

In the opinion of Cai et al (2022), in regard to the emergency e-learning (online classes/teaching), most beneficial academic communications of various types have not been made subject for research in adequate measure. There have been preliminary studies which showed that online learning by students had negative impact on their academic performance and engagement; this is true of classes held in non-digital classrooms. This research aimed at investigating: (i) academic engagement; (ii) perceived learning; and (iii) academic achievement. The college students' participation in virtual learning environments has been studied. This study added to the existing literature as far as the impact of academic engagement had occurred on the outcomes in online learning environments.

Physical contact with teachers is better student engagement in learning than virtual student engagement. Student engagement has, therefore, been given major or overbearing focus by educational research scholars due to its great influence on students' academic achievement. According to the current studies

on this topic, the conclusions reached indicated that more student interaction contributed towards enhancing the learning experience and increased the subject knowledge. Bayoumy and Alsayed (2021) found in his study that student-engagement increased knowledge of topic/subject taught. This study has broken down the academic engagement into three components: (i) cognitive; (ii) behavioral; and (iii) emotional. These components have been used as the basis. This paradigm revealed that academic engagement affected both, the perceived learning and the school accomplishment. The students formed perceptions of their own learning and academic achievement. These perceptions were influenced by all the three aspects (components of engagement) – namely cognitive, behavioural, and emotional), as shown in Figure 1 below. All the three factors integrate to work together to give pupils their final scores; this is depicted in the Figure 1 below.

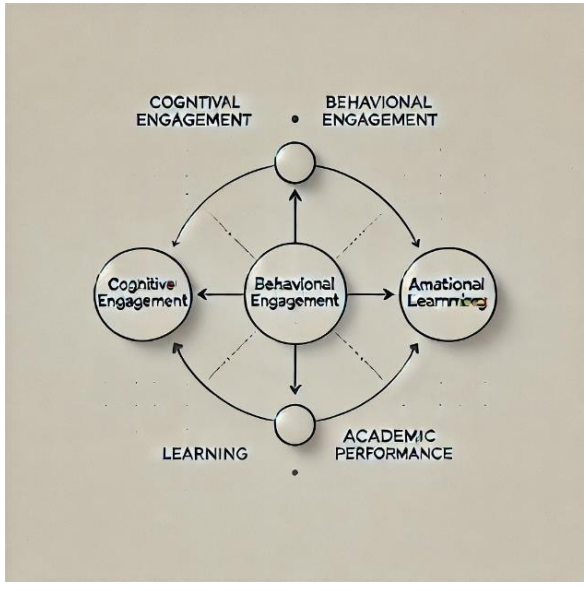

Figure – 1: *Model in theory*

Methods

This study used quantitative research design. A survey was conducted and the data collected for analysis by Saudi students' Academic Engagement Scale. Virtual Learning Perception Scale (VLPS) questionnaire was developed to check students' perceptions. The study took place in Saudi Arabia in the Academic year 2023-2024.

Participants

The study had selected 177 students at a Saudi university for the purpose. Those students-participants engaged for this study ranged in age from 18 to 32 years with an average age of 20.86 years. Those students were enrolled for academic programmes at various universities in Saudi Arabia. The total numbers of participants included 173 females (57.5%), 4 males (41.2%), and 1 other category participant (1.3%). The sample of students was composed of individuals from various academic disciplines, with the following distribution: commerce (5.33%); social sciences (5.63%); arts (6.93%); language (16.53%); STEM fields (16.93%); psychology (18.67%); and law (18.97%). An additional 6.67% of participants came from other diverse fields of study. Participants' average grades ranged from 10 to 18, yielding a mean of 15.36 and a standard deviation of 1.58.To effectively gather the necessary data required for the study, web-based survey was used. Prior to completing the questionnaires, participants were briefed on the study-objectives and were asked for their permission. In turn, assurance was given to the study-participants to keep their identity and responses confidential. The survey covered assessment of academic involvement and perceived learning. Ademographic sheet was prepared. .

Instruments Used for collecting data

Age, gender, instructor, and GPA from the sample-students the most recent semester were collected using a data sheet. Socio demographic data was collected using this sheet.

The Academic Engagement Scale (AES), developed from recent research by Wang et al. (2021), was utilized to assess the degree of academic involvement. Munoz Suarez et al (2022) conducted a study and reported on the basis of the data analysis that the Academic Engagement Scale (AES) exhibited strong

reliability in prior studies as worked out by Cronbach's alpha value exceeding 0.90. The scale used for this calculation consisted of fifteen items which were divided into three sub-scales: (i) intellectual engagement; (ii) emotional involvement; and (iii) behavioural involvement. In the opinion of Wang et al (2021), while emotional engagement reflected sense of belonging and excitement (sentimental engagement), behavioural engagement was expressed by way of active involvement in learning activities.

Students' psychological involvement as well as approaches followed to learning was taken into consideration for assessing cognitive engagement of the sample-students. Virtual Learning Perception Scale (VLPS), developed from Sher (2020) and Rovai et al (2020), was used for assessing 'perceived learning'. Taking benefit of investigation results of Ledesma et al (2021) about self-perceptions, the present researcher used a six-item one-dimensional measure to assess and evaluate the 'self-perceptions' formed by the students about their level of comprehension and mastery of the material taught in the course. The analysis showed that there was 91% correlation between Cronbach's alpha and Kaiser-Meyer-Olkin (KMO). As a result of this analysis, the result indicated that the scale was psychometrically reliable.

Procedures

For completing this study, the RStudio programme was adopted. It was necessary to cleaning up data as the first step and, for this purpose, outliers and missing data from the original set were found. After treating the collected data, resort was made to the descriptive statistics. As suggested by Mardia (2021) for this kind of study Mardia test was used to see whether the collected data followed a normal distribution across many variables. Satorra and Bentler (2021) have used structural equation modeling (SEM) by using the maximum likelihood estimate approach. In this study also, the Satorra-Bentler adjustment formula was used to account for non-normality. Model fit was evaluated using the following metrics: Standardized Root Mean Square Residual (SRMSR), Root Mean Square Error of Approximation (RMSEA), Tucker-Lewis Index (TLI), and Comparative Fit Index (CFI). The recommendations made by Brown (2021), Mueller and Hancock (2020), and Schreiber et al (2020) were adhered to. In their 2020 study, Schreiber and colleagues determined that the CFI and TLI values

were taken as more than 0.90, the RMSEA was taken as less than 0.06, and the SRMR was taken as less than 0.08. These values were considered in this study.

Results

Before Structural Equation Model (SEM) analysis was conducted, Mardia's test was used to check for multivariate normalcy assumption. The analysis indicated a violation of the normality assumption, highlighted by significant multivariate skewness ($\gamma 1$, $p = 3976.889$, $p < .001$) and kurtosis ($\gamma 2$, $p = 28.999$, $p < .001$). To mitigate the issue of non-normality, single-equation modeling (SEM) was employed. The maximum likelihood estimation method was utilized, incorporating the Satorra-Bentler adjustment as recommended by Satorra and Bentler (2001). Refer to Table 1 below:

Table - 1: *Structural Equation Modelling*

Statistic/Analysis	**Value**	**Interpretation**
Multivariate Normality Check		
Multivariate Skewness ($\gamma 1$)	3976.559, $p < .001$	Indicates significant skewness, violation of normality assumption
Multivariate Kurtosis ($\gamma 2$)	28.669, $p < .001$	Indicates significant kurtosis, violation of normality assumption
Model Fit Indices		
χ^2(df)	315.065 (201), $p < .001$	Indicates significant model fit, but requires further checks
Satorra-Bentler χ^2 (S-Bχ^2)	1.252	Acceptable fit (values close to 1 indicate good fit)
CFI (Comparative Fit Index)	0.956	Good fit (values > 0.95 indicate excellent fit)
TLI (Tucker-Lewis Index)	0.949	Good fit (values close to 0.95 indicate good fit)

RMSEA (Root Mean Square Error of Approximation)	0.043 (95% CI: 0.035 - 0.051)	Good fit (values < 0.05 indicate a good model fit)
SRMR (Standardized Root Mean Residual)	0.062	Acceptable fit (values < 0.08 indicate good fit)

The model and data display a strong fit, as shown by the following values: Comparative Fit Index (0.891), Tucker-Lewis Index (0.944), Root Mean Square Error of Approximation (0.041), and Standardized Root Mean Square Residual (0.059). When the facts were looked at, this was proven to be true. The structure pathways and substantial regression analyses between each factor are shown in Figure 2 below. The regression analysis clearly shows that mental involvement ($\beta = 0.447$, $p < .01$) and emotional involvement ($\beta = 0.230$, $p < .05$) are very important factors that strongly predict how much someone learns. Clearly, in all the ways in which students can participate make a big difference in finding how well their learning is evaluated. Notably, there was no significant link between psychological participation and perceptions of learning ($\beta = 0.035$, $p = .840$), which shows that different types of interaction have different effects on learning results. The research showed that behavioural participation significantly influenced academic achievement ($\beta = 0.393$, $p < 0.05$). No significant effect on academic achievement was observed by student-participants' cognitive involvement ($\beta = -0.164$, $p = .301$) or emotional involvement ($\beta = 0.001$, $p = .991$). Even while cognitive and emotional involvement are required for perceived learning, these studies indicate that behavioural engagement is a better predictor of actual academic achievement (Table 2).

Table 2.*Regression model*

Regression Analysis	**Value**	**Interpretation**
Dependent Variable: Perceived Learning		
Mental Involvement (β)	0.447, p < .01	Significant positive predictor
Emotional Involvement (β)	0.230, p < .05	Significant positive predictor
Psychological Involvement (β)	0.035, p = .840	No significant effect

Dependent Variable: Academic Achievement		
Behavioural Involvement (β)	0.393, p < .05	Significant positive predictor
Cognitive Involvement (β)	-0.164, p = .301	No significant effect
Emotional Involvement (β)	0.001, p = .991	No significant effect

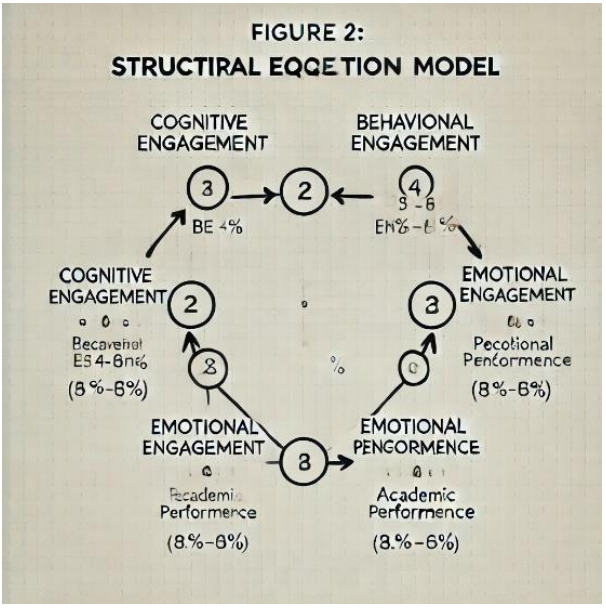

Figure – 2:. *Structural equation model*

Discussion

The present researcher has studied the psychological, behavioural, and emotional implications of academic engagement on students' performance in

learning. Students are expected to be emotionally devoted for participating actively in the class, but the data reveals that engaged students (in teacher-taught interaction mode) do better intellectually. These ideas may be utilized in online courses. Earlier studies made on this topic had shown that students' emotional and cognitive involvement affected learning. This finding aligns with finding of Subramaniam and Mahmood (2021) and Fredricks et al (2021) whose research had revealed that emotional and cognitive engagement improved students' learning perspectives.

The present researcher also shares his view on the basis of personal observation that performance of students is improved when they are emotionally and academically engaged. It is because of this that the importance of emotional and cognitive engagement becomes significant in online classrooms.

In a study made by Kuh (2020), he says that even though he was able to predict academic achievement via behavioural engagement, it did not have any impact on perceived learning. This was the case despite the fact that behavioural engagement was evaluated based on students' attendance and the completion of assignments by them.

Kuh (2020) expressed his opinion also in the context of conventional face-to-face learning after his study revealed continuous interaction between student-learners and their teachers was significant in improved learning. He asserted that conventional face-to-face learning, which is characterized by more organized participation and more direct connection, between the instructor and the participants, was responsible for better performance of students. Kuh (2020) further asserts that behavioural engagement was of the highest significance in the learning process.

Fernández-Otoya et al (2022) says with respect to ChatGPT and puts emphasis on granting autonomy to learner-students and let them unction with self-regulation for better learning. The scholars add that this change may explain why behavioural engagement was less important in perceived learning as per results of their research.

Abou-Khalil et al (2021) express their opinion in the use of online technology used for teaching-learning. They state further that the technology used in

education, and internet availability, may hinder students' behavioural engagement as found by them in their study.

Teng & Wang (2021); and Walker & Kovalevsky (2021) have not commented on the manner of instruction but they are convinced that, based on their study's findings, there is strong need of implementing classroom interaction programmes, not online/virtual programmes because they stress that cognitive and emotional participation were increased by the use of activities such as debates, discussions, quizzes, guest lectures, cultural functions and formative assessments in the classroom setting.

In the opinion of Martínez et al (2019), education institutions (schools) may choose to use LMSs to track class-attendance and assignment-completion tasks for working through these components in improving student-behaviour. They also opine that, besides cognitive ability and examination/test scores, these measurements (attendance and assignments) may prove factors which would enhance academic performance of student-learners.

This (current) research having been cross-sectional, it could not track engagement and learning results. For that purpose, longitudinal study is required to be done which would, then, help to determine how engagement affects learning over time.

According to Mishra (2020), integration of personality factors, self-efficacy, and IQ may assist researcher to find explanation as to how engagement affected academic achievement o learner-students. In the views of James et al (2022), traditional indicators like high school achievement and student engagement in the extra-curricular activities might help in enhancement in academic knowledge.

Akhter et al (2022) state that potential future research might focus on the variables of age, gender, and socio-economic condition of families of students as these are the factors which, they consider, impact online learning.

Based on an investigation conducted by Ferri et al (2020) who concurred with the observation/opinion of Akhter et al (2022), showed that students' emergency online learning might have been influenced by their socio-economic situation as the socio-economic status influenced the technology and education sectors. The

scholars recommended that knowledge about these external issues was necessary to provide a comprehensive online education to all pupils, they said so because they were of the firm understanding that the student-learners were paramount in the setting of online university attendance.

According to Zhao et al (2022), urge to have experience of the modern education technology met the pupils' psychological requirements as they felt highly satisfied by the epidemic conditions, which improved their academic performance. As per Alturki & Aldraiweesh (2022), the students expected and demanded better virtual learning environment.

From the above discussion, it is clear that virtual education environment is not as conducive to student learning as the physical environment is when students can engage in interaction with the teachers and participate in discussions, debates, quizzes, social functions and cultural programmes. Virtual education introduces impersonal relationship and makes students and teachers feel remoteness thus affecting interaction which is very necessary for efficient education system for producing well rounded student-personality and create practical professionals with market needed skills.

Conclusion and Recommendations

The outcomes of this research suggest numerous ways to improve virtual learning, student engagement and performance. Educational institutions should promote cognitive and emotional involvement since they affect learning. Debates, problem-solving, and case studies, together with supportive teacher-student interactions, make learning more engaging and thus rewarding too. Even if behavioural engagement does not improve perceived learning, it affects academic accomplishment. It is necessary to use learning management systems to track attendance, assignment submissions, and active student-involvement. Interactive technologies like virtual simulations, digital infrastructure, and technology training may increase involvement. Personalizing learning to meet diverse learning styles and providing equal access to digital resources, particularly for students from low-income families, can also boost engagement and academic achievement. Future research should control for personality, self-efficacy, and demographic variables that may impact engagement and academic achievement to evaluate the long-term effects of participation. Using AI, VR,

and gamification with instructor involvement may increase virtual learning quality and student performance.

Results affect Qassim University's philosophy and practice. Emotional, behavioural, and cognitive engagement affect virtual learning and academic performance. Virtual learning improves cognitive engagement and learning style with emotions. At Qassim University, students' learning styles need flexible methodologies. Formative assessments, collaborative tools, and emotionally engaging content are needed to engage and help students succeed in academic achievement.

Qassim University professors may engage students with improved/revisited course design. Students may benefit from cognitive and emotional engagement technologies and emotionally supportive virtual learning environments. Inclusive learning requires technology and digital tools for all socio-economic classes. These metrics may improve Qassim University's virtual and hybrid education.

References

Abou-Khalil, V., Helou, S., Flanagan, B., Chen, C. M., & Majumdar, R. (2021). Emergency remote teaching during COVID-19: The impact of perceptions and engagement on academic performance. *Journal of Educational Technology Development and Exchange, 14*(1), 21-37.

Adedoyin, O. B., &Soykan, E. (2020). COVID-19 pandemic and online learning: The challenges and opportunities. *Interactive Learning Environments*, 28(1), 1-13.

Aguilera-Hermida, A. P. (2020). College students' use and acceptance of emergency online learning due to COVID-19. *International Journal of Educational Research Open, 1*, 100011.https://doi.org/10.1016/j.ijedro.2020.100011

Akhter, N., Saleem, K., & Rehman, S. (2022). The impact of age, gender, and socioeconomic factors on virtual learning engagement during the COVID-19 pandemic. *International Journal of Educational Research*, 45(3), 122-135.

Ali, W. (2020). Online and remote learning in higher education institutes: A necessity in light of COVID-19 pandemic. *Higher Education Studies*, 10(3), 16-25.

Alturki, U., &Aldraiweesh, A. (2022). The role of cloud platforms and social networks in enhancing virtual learning environments. *Journal of Educational Technology Systems*, *50*(2), 145-162.

Aucejo, E. M., French, J., Araya, M. P. U., & Zafar, B. (2020). The impact of COVID-19 on student experiences and expectations: Evidence from a survey. *Journal of Public Economics*, 191, 104271.https://doi.org/10.1016/j.jpubeco.2020.104271

Besser, A., Flett, G. L., & Zeigler-Hill, V. (2020). Adaptability to a sudden transition to online learning during the COVID-19 pandemic: Understanding the challenges for students. *Scholarship of Teaching and Learning in Psychology*, 8(2), 85-103.

Cai, Z., Fan, X., & Du, J. (2022). Academic engagement and learning outcomes of Chinese students in emergency remote teaching of online education during COVID-19: The mediating role of self-regulated learning. *Frontiers in Psychology*, 13, 807220.

Chen, T., Kaczmarek, K., & Ohyama, H. (2021). Student perceptions of online learning during the COVID-19 pandemic: A survey study of dental students. *Journal of Dental Education, 85*(9), 1205-1212.

Dhawan, S. (2020). Online learning: A panacea in the time of COVID-19 crisis. *Journal of Educational Technology Systems*, 49(1), 5-22.

Fernández-Otoya, R., Raposo-Rivas, M., & Halabi-Echeverry, L. (2022). Differences in engagement between traditional and online learning environments: A comparative study. *International Journal of Educational Technology in Higher Education*, 19(3), 12-25.

Ferri, F., Grifoni, P., & Guzzo, T. (2020). Online learning and emergency remote teaching: Barriers, challenges, and recommendations. *International Journal of Educational Technology in Higher Education*, 17(1), 1-23.

Fredricks, J. A., Wang, M.-T., & Binns, K. (2021). Engagement in school: Cognitive and emotional perspectives in the context of virtual learning. *Educational Researcher*, 50(6), 375-387.

Gonzalez, T., De La Rubia, M. A., Hincz, K. P., Comas-Lopez, M., Subirats, L., Fort, S., & Sacha, G. M. (2020). Influence of COVID-19 confinement on students' performance in higher education. *PLOS ONE*, 15(10), e0239490.

Hazaea, A. N., Bin-Hady, W. R. A., &Toujani, M. M. (2021). Emergency remote English language teaching in the Arab league countries: Challenges and remedies. *Computer-Assisted Language Learning Electronic Journal*, *22*(1), 207-229.

Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The difference between emergency remote teaching and online learning. *Educause Review*, *27*, 1-12.

James, L., Zhang, X., Li, C., Ziegelmayer, T., & Villacis-Calderon, E. (2022). Controlling for personality traits and intelligence in the study of engagement in academic performance. *Educational Psychology Review*, 34(4), 567-592.

Kuh, G. D. (2020). The role of student engagement in predicting academic outcomes: Implications for online learning. *Journal of Educational Psychology*, 112(5), 789-805.

Ledesma, R., Molina, S., & Valero, L. (2021). Examining perceived learning in virtual education: Insights from recent studies. *Journal of Educational Psychology*, *113*(2), 25-45.

Martin, F., Xie, K., & Bolliger, D. U. (2022). Engaging learners in the emergency transition to online learning during the COVID-19 pandemic. *Journal of Research on Technology in Education, 54*(sup1), S1-S13.https://doi.org/10.1080/15391523.2021.1991703

Mardia, K. V. (2021). Testing multivariate normality in large data sets. *Journal of Multivariate Analysis*, 200, 104558.

Martínez, R. J., Smith, M. C., & Roberts, J. C. (2019). The predictive value of engagement in explaining

Mishra, P. (2020). The role of self-efficacy and intelligence in predicting academic success: Evidence from CHAT GPT settings. *Journal of Educational Psychology*, *115*(2), 134-145.

Bayoumy, H. M. M. E., & Alsayed, Z. (2021). The impact of student engagement on academic performance: Insights from higher education. *Journal of Educational Psychology*, *12*(2), 45-56.

Muñoz-Suárez, A., Gómez-Baya, D., & Cruz-Rodríguez, A. (2022). Engagement in academic tasks: A multi-dimensional approach. *Educational Psychology Review*, *34*(1), 67-90.

Muthuprasad, T., Aiswarya, S., Aditya, K. S., & Jha, G. K. (2021). Students' perception and preference for online education in India during COVID-19 pandemic. *Social Sciences & Humanities Open*, 3(1), 100101.https://doi.org/10.1016/j.ssaho.2020.100101

Rovai, A. P., Wighting, M. J., Baker, J. D., & Grooms, L. D. (2020). Students' perceptions of learning and engagement in virtual environments. *Journal of Online Learning Research, 5*(3), 210-225.

Satorra, A., & Bentler, P. M. (2021). A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika, 64*(4), 507-514.

Schreiber, J. B., Nora, A., Stage, F. K., Barlow, E. A., & King, J. (2020). Reporting structural equation modeling and confirmatory factor analysis results: A review. *Journal of Educational Research, 113*(2), 88-101.

Sher, A. (2020). Online learning experiences: Assessing perceived learning and engagement. *Computers & Education, 156*, 103936.https://doi.org/10.1016/j.compedu.2020.103936

Subramaniam, M., & Mahmood, K. (2021). Emotional engagement in virtual classrooms: Exploring the link between students' emotions and online academic success. *Journal of Educational Computing Research*, *59*(4), 711-727.

Tadesse, S., &Muluye, W. (2020). The impact of COVID-19 pandemic on education system in developing countries: a review. *Open Journal of Social Sciences, 8*(10), 159.http://doi.org/10.4236/jss.2020.810011

Teng, Y., & Wang, H. (2021). Enhancing cognitive and emotional engagement in online learning: Strategies and outcomes. *International Journal of Educational Technology*, *18*(2), 134-152.

UNESCO (2021). One year into COVID: Prioritizing education recovery to avoid a generational catastrophe. *UNESCO Policy Brief*, April 2021.

Walker, J. D., &Koralesky, K. E. (2021). Using formative assessments and active learning strategies to enhance cognitive engagement in online classrooms. *Journal of Online Learning Research*, *7*(1), 34-47.

Wang, M. T., Fredricks, J. A., Ye, F., Hofkens, T. L., & Linn, J. S. (2021). The roles of engagement, motivation, and

learning strategies in predicting academic outcomes in virtual education. *Educational Researcher*, *50*(4), 255-267.

Zhao, J., Cao, Y., Li, M., & Li, Q. (2022). Addressing students' psychological needs to foster online academic success during the pandemic. *Journal of Educational Psychology*, *114*(3), 567-583.