Effectiveness, Challenges and Psychological Impacts on Adoption of Online Learning – The Case of Open University of Mauritius

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Abstract

The coronavirus epidemic significantly affected the global educational system. The closure of educational institutions hindered the effective operation of the system, restricting learners' knowledge acquisition and impeding the activities of educational authorities, stakeholders, and policymakers. This study examines the efficacy, obstacles, and psychological effects of implementing online learning for students at the Open University of Mauritius. The study's research design includes an extensive literature analysis and the gathering of primary data from 373

participants – with a response rate of 72.9%. This research, therefore, adopted a quantitative approach. Bivariate analyses were employed to evaluate the hypotheses. It was observed that the efficacy of online learning is significantly diminished in terms of course content comprehension and knowledge retention without the support of tutors. In addition, the obstacles of online learning, such as difficulties in comprehending the language medium and the learning content, are significantly exacerbated by the lack of tutor help. Finally, the psychological effects of online learning significantly influence the pleasure and enjoyment of individuals in the absence of adequate tutor support. In short, insufficient tutor support influences the efficacy and psychological effects of online learning, although it does not alter the problems associated with it. It is expected that this research will aid policymakers in assessing the efficacy, obstacles, and psychological effects of online learning for university students in general.

Keywords: Online Learning, Psychological Impacts, COVID-19.

1. Introduction

The coronavirus epidemic has profoundly affected the global educational system. The shutdown of educational institutions has caused disruption of the effective operation of the system, hindering learners' knowledge acquisition as well as impeding the activities of educational authorities, stakeholders, and policymakers. Over 168 million pupils globally have been deprived of decent education for approximately an entire year [Chaker et al. 2022]. While the closure of educational institutions was regarded as an efficient approach to curb the transmission of the COVID-19 virus, several teachers and investigators have expressed apprehensions about the impact of these shutdowns on students' grades and inequality in education. Given the uncertainty over the conclusion of the COVID-19 pandemic, educational institutions worldwide had initiated online learning to guarantee the continuity of students' education while they were staying at home [Mohd et al. 2021].

2. Literature

2.1 Overview of Online Learning

The literature pertaining to online learning is developing at a tremendous pace. It has been posited that the learners' perspective on online learning is the most crucial factor for successful online education [Li et al. 2022]. Evaluating online learning is also essential as it facilitates the analysis of student performance, the assessment of the effectiveness of online tutorials, and the prediction of failure risks [Zhang et al. 2022]. Moreover, students must familiarise themselves with modern learning methodologies to adapt to current circumstances [Su et al. 2022]. Students must keep pace with social change by adapting to the availability of new technology [Mohd et al. 2021]. Consequently, learners will possess a variety of technological skills that they can employ in the future [Mohd et al. 2021; Wang et al. 2022]. Nevertheless, the presence of digital portals and current methods of communication persists in enabling educators to facilitate the learning experiences of their pupils online [Penrod et al. 2022].

2.2 Benefits of Online Learning

Digital schooling is easily obtainable, offering improved academic possibilities for students residing in the countryside and remote places with limited facilities [Khoury, 2022]. Scholars contend that the widespread implementation of distance learning may enhance the quality of instruction [Guo et al. 2022]. This promotes the exploration and analysis of many perspectives in contrast to traditional learning [Shukor et al. 2015]. Online learning facilitates the documentation of learners' progress, enabling evaluation of their collaborative learning experiences [Mohd et al. 2021]. Through effective engagement on an online platform, educators and learners remain connected while being in different locations. The integration of sophisticated technology in education facilitates the global dissemination of information through online learning [Mohd et al. 2021]. Furthermore, online education allows students to engage in their studies inside a safe environment without the necessity of venturing outdoors [Yao et al. 2022]. Students can acquire knowledge from recorded tutorials provided by the instructor and obtain information from e-books [Khoury, 2022]. Education via the internet permits learners to advance at their individual speed and cultivates a

greater sense of ease [Tang et al. 2022]. The advantages of online education have been extensively studied and are indisputable.

2.3 Determinants of Online Learning Efficacy

The determinants of online learning efficacy are discussed as follows:

2.3.1 Comprehensive understanding of educational materials

An effective online course is entirely interactive [Dong et al. 2020]. It provides students with resources such as reading materials and recorded videos, while also fostering positive relationships between the instructor and the learners. It is highly appealing and demanding for students. It encourages learners to engage in online sessions, enhances their motivation, and captures their attention and enthusiasm. It emphasises the joy of learning and encourages learners to enhance their skills, abilities, and consciousness [Malysheva et al. 2022].

2.3.2 Focus during virtual education

The coronavirus pandemic has compelled many colleges and universities to shift to distance learning. Nonetheless, it was disclosed that the remote educational atmosphere and numerous outside disturbances may negatively impact pupils' attention abilities [Gellisch et al. 2023].

2.3.3 Retention of Information in Online Learning

It was identified that the potency of newly formed connections in the human brain directly correlates with the strength of knowledge retention. Online education is increasingly accepted, and the number of online learners is steadily growing. However, learner retention rates appear to be significantly lower than those in conventional educational settings. Notwithstanding the substantial study carried out, many organisations persist in their quest for ways to address this problem [Bowles et al. 2003].

2.3.4 Facilitation of assignment completion through online learning

Online coursework constitutes a fundamental component of distance learning [Feldman-Maggor et al. 2022]. Utilising the internet and digital

resources, online assignments can be effectively planned, arranged, and moderated. Online assignments also allow educators to gain a clearer grasp of the challenges that learners may face. As a result, tutors can more readily provide guidance to students. Students can employ online resources to identify areas of deficiency requiring enhancement [Maggor et al. 2022].

2.3.5 User-friendliness of computer operation

It was observed that in situations where learners must invest significant time in comprehending how to use computers for studying course materials, it hinders their effective learning [Schroeders et al. 2011]. A fundamental level of literacy skills is essential, including the ability to read and write, operate a computer keyboard, employ Microsoft Word, and navigate the internet [Zulfikar et al. 2019]. This ICT knowledge is a prerequisite [Hernández-Sellés et al. 2019].

2.4 Obstacles Encountered by Students in Online Learning

The increasing focus on online collaborative learning has resulted in some challenges in evaluating the online joint learning experience [Shukor et al. 2015]. Prior research claimed that previous experience with ICT utilisation and adequate internet access are the primary determinants of effective online learning [Linjawi et al. 2018]. Additional obstacles include insufficient communication between learners and tutors, interaction among learners, and issues related to connectivity. It was also found that online learning can be more challenging than in-person instruction for both educators and students, as it necessitates a period of adjustment to the new learning methodology [Mohd et al. 2021].

2.4.1 Psychological effects experienced by students during online education

Mental issues frequently hinder learners from appreciating online education [Holubnycha et al. 2021]. The deterioration of mental health can be seen as a manifestation of the psychological effects of the coronavirus pandemic [Holubnycha et al. 2021].

2.4.2 Deficiency of motivation

Typically, learners possess a limited capacity for information absorption, and the combination of several learning approaches may induce cognitive fatigue, hence diminishing their ability to adequately comprehend new knowledge [Bostan et al. 2022]. Mental health issues are the primary impediment to scholarly success. They may reduce students' inspiration, concentration, and interaction with others, all of which are crucial factors for successful learning [Huang et al. 2022; Bostan et al. 2022].

2.4.3 Stress

Learning facilities need to be prepared to manage a diverse array of emotional and behavioural challenges faced by learners [Zheng et al. 2021]. Previous studies indicated that a significant component that influences learners' stress is the considerable strain associated with lectures given online, necessitating their engagement with digital media for educational purposes [Ravari et al. 2020]. Thus, this may negatively impact the academic performance of pupils [Richardson et al. 2020].

2.4.4 Anxiety

Recent research among Chinese medical college students indicated that elevated levels of anxiety were associated with factors closely related to the coronavirus pandemic [Cao et al. 2020]. Students' diminished connection with human interaction adversely affected them cognitively and mentally [Gosselin et al., 2022]. Panic has intensified in numerous persons because of the looming prospect of grief from coronavirus and heightened security actions [Yesilot et al. 2022].

2.4.5 Major depressive disorder

The influence of coronavirus on academic achievement is linked to elevated psychological and mood levels, which correspond with an increased frequency of attempted suicides [Yamamori et al. 2023]. Previous studies indicated that the apprehension over death from the coronavirus has compelled authorities globally to enact procedures for monitoring the virus's trajectory, negatively affecting the mental health of citizens and learners [Spinhoven et al. 2022].

2.5 Conceptual Background

At present, online learning is prevalent and is regarded as an alternative to expensive in-person lectures, eliminating the necessity for a physical classroom [Zulfikar et al. 2019]. Online learning is increasingly popular due to technical advancements that facilitate remote communication [Shukor et al. 2015; Zhang et al. 2022]. Moreover, students must familiarise themselves with modern learning methodologies to adapt to current circumstances [Zhang et al. 2022; Mohd et al. 2021; Su et al. 2022].

Innovation in the education sector must continue to ensure that technical advancement persists. Students must adapt quickly to societal changes by familiarising themselves with the availability of new technology [Mohd et al. 2021]. Consequently, learners will possess a variety of technological competencies that they can employ in the future [Wang et al. 2022]. Nonetheless, the existence of social media platforms and other modern communication tools continues to empower instructors to guide learners' online educational experiences [Mohd et al. 2021; Penrod et al. 2022].

A considerable number of studies have been conducted on the efficacy, obstacles, and psychological effects of online learning for students [Chang et al. 2021; Shukor et al. 2015; Bui et al. 2022; Hasan et al. 2020]. If students do not dedicate substantial time to acquiring technological abilities for understanding course material, it impedes their successful education [Schroeders et al. 2011; Nguyen et al. 2022]. Notwithstanding the substantial research undertaken, several organisations persist in their pursuit of remedies for this problem [Bowles et al. 2003]. Certain researchers assert that online learning is ineffective and conducted inadequately. They articulate this about several factors, such as inadequate internet connectivity, instructors' inability to implement online learning effectively, and the absence of support from immediate family members [Mohd et al. 2021].

A multitude of students encounter various depressive mental illnesses and generalised anxiety [Hossain et al. 2021]. Motivation is a fundamental element in every individual. It will assist an individual in performing activities more effectively through willpower [Bostan et al. 2022].

The online learning employed for daily coursework and academic performance evaluation can also lead to student stress. One of the primary factors contributing to learners' stress levels is the intense pressure of online lectures, which compels them to employ online media

for their education [Ravari et al. 2020]. Consequently, this may adversely affect the academic achievement of the students [Richardson et al. 2020]. In online learning, tutors provide greater encouragement and validation of learner contributions compared to tutors in in-person sessions [Zulfikar et al. 2019]. Cognitive engagement can significantly enhance learners' social presence to a certain extent [Zulfikar et al. 2019; Chang et al. 2021]. Educators must possess the ability to inspire students to achieve academically [Chang et al. 2021].

3. Methodology

3.1 Research Model/Design

This study employs quantitative research. It is a research strategy that prioritises data quantification, collection, and analysis [Hussain et al. 2019]. It seeks to understand the causal or correlational link between independent and dependent variables through hypothesis testing. The authors meticulously employed formal hypothesis testing procedures to assess independent and dependent variables, generate precise projections, and systematically collect data prior to reaching a valid result [Choi et al. 2020; Huan-Niemi et al. 2016].

The primary purpose is: (1) to assess the efficacy of online learning adoption, (2) to evaluate the challenges affecting the adoption of online learning and (3) to investigate the psychological effects of adopting online learning.

This research was mainly guided by the following research questions and research hypotheses:

Does efficacy influence the acceptance of online education? **H1:** The influence of tutors helps on the efficacy of online learning adoption.
Do difficulties influence the uptake of online learning? **H2:** The impact of tutor assistance on the challenges of online learning adoption.

Do psychological factors influence the uptake of online learning?
H3: The tutor's support influences the psychological effects associated with the adoption of online learning.

3.2 Data Collecting Tools

An online survey utilising a questionnaire (Google Form) was employed to examine the effects of tutor assistance on the efficacy, obstacles, and psychological consequences of online learning for university students. The instrument employs a rating system with five points for responders to express their answers. The instrument was crafted to ensure that learners answered all questions and that all returned questionnaires were fully completed.

3.3 Participants

The survey was disseminated to 373 students through email and WhatsApp. Stratified sampling involves obtaining a random selection from a specific subgroup within the research population. Each subgroup is isolated from others based on familiar characteristics such as sexual orientation, race, or religion [Subzar et al. 2023]. This ensures that every subgroup of the research population is adequately represented within the overall population. The population size was obtained from the Open University website which indicates that the enrolment is 12,221 students. The Raosoft calculator was employed to ascertain the sample size, which turned out to be 373 pupils. Learners from diverse courses were randomly chosen for the research by stratified sampling, as demonstrated in Table 1. A reply rate of 72.9% (N=373) was attained.

Table 1: Sampling Elements and Response Rate

Course name	No. of learners who participated in the survey	No. of Responses	Response rate
Certificate in School Management SEDEC	2	1	50.00
Foundation	73	66	90.41
BA (HONS) Law and Management	22	15	68.18
BSc (Hons) Finance and Taxation	20	18	90.00
BSc (Hons) Applied ICT with Specialisation	3	2	66.67
BA (Hons) English	17	13	76.47
BA (Hons) Graphic Design and Multimedia	16	9	56.25
MSc Financial Management and Taxation	10	9	90.00
Master of Laws (LLM) in Business Law and Governance	15	15	100.00
MBA programmes	195	124	63.59
TOTAL	**373**	**272**	**72.9 %**

The survey responses were evaluated by generating descriptive statistics. The quantitative data were examined utilising Excel and the Statistical Package for the Social Sciences (SPSS 26.0).

3.4 Validity and Reliability

The questionnaire underwent validation via pilot testing, during which its items were reviewed with ten learners to pinpoint ambiguities and misinterpretations. Furthermore, content validity was established by evaluating the relevance and sufficiency of the items with the ten learners. Cronbach's Alpha (1951) demonstrated that the items utilised to assess the various aspects were dependable. The Cronbach Alpha score is 0.918, while the sample adequacy statistic (KMO) is 0.862. Both meet the permissible level.

3.5 Limitations

The key limitation of this study is that the respondents were from only one open university. It will affect the generalisation of the results and the external validity of the study. The results cannot be extrapolated to other contexts. Other limitations are in terms of the interviewer's bias during the data collection phase.

4. Findings and discussions

4.1 Effectiveness of Online Learning without Tutor's Assistance

Most learners indicated that their information retention is significantly diminished in the absence of adequate tutor support during online sessions. Consequently, *adequate tutor support is a crucial factor in enhancing information retention among learners in online education*. The current study is partially aligned with the previous research conducted by Bowles et al. (2003).

Most learners confirmed their excellent proficiency in computer usage without formal tutor help during online sessions. Consequently, *the tutor's support appeared to have minimal effect on the proficiency of computer usage, since most learners currently exhibit strong ICT skills*. The present study corresponds with the previous research conducted by Schroeders et al. (2011), Thuy Nguyen et al. (2022), and Zulfikar et al. (2019).

Figure 1: Percentage response of learners' perceptions about the effectiveness of online learning

No.	Sub variables	Percentage of Learners						Interpretation
		Very Low	Low	Medium	High	Very High	Total of agreement (M, H and VH)	
1	Information retention during online learning	(110) 40.4%	(92) 33.8%	(66) 24.3%	(4) 1.5%	(0) 0%	25.8%	Low
2	Ease of computer usage during online learning	(2) 0.7%	(9) 3.3%	(61) 22.4%	(116) 42.6%	(84) 30.9%	95.9%	High

4.2 Challenges of Online Learning without Tutor's Assistance

Figure 2 illustrates that most learners (46.7%) strongly concurred that *they encounter difficulties comprehending the learning material without adequate tutor support throughout their online sessions*. The present research is partially aligned with the previous study by Gehle et al. (2023), which corroborated the current results.

The current study revealed that *most learners said that they do not experience an inconsistent internet connection in the absence of adequate instructor support during their online lessons*. The Internet connection is primarily determined by the Internet package and service provider. The present research is entirely congruent with the previous work of Valentín-Sívico et al. (2023), which demonstrated consistency with the established findings.

In the absence of adequate tutor support, 24.3% of students denied that their computer systems usually crash, while 41.5% strongly disagreed. Therefore, it may be concluded that adequate tutor help appeared to have little effect on the machine. The present research aligns entirely with the previous work of Dsouza et al. (2010).

A significant proportion of learners (35.7%) strongly concurred that *they encounter eyestrain issues in the absence of adequate tutor support throughout their online sessions*. Consequently, it appears that adequate tutor help did influence the issues related to eyestrain. The research conducted by Singh et al. (2021) corroborates the present investigation, which indicates the occurrence of eyestrain.

No.	Sub variables	Percentage of Learners						
		Strongly Disagree	Disagree	Moderately Agree	Agree	Strongly Agree	Total of agreement (M, H and VH)	Interpretation
1	Difficulty understanding the learning content	0.4%	5.9%	3.3%	43.8%	46.7%	93.8%	High
2	Unstable internet connection	9.9%	64.7%	22.8%	2.2%	0%	25%	Low
3	Computer system crashes frequently	41.5%	24.3%	32.7%	1.5%	0%	34.2%	Low
4	Eyestrain problem	1.1%	2.9%	25%	35.3%	35.7%	96%	High

Figure 2: Percentage response of learners on the challenges of online learning

4.3 Psychological Impacts of Online Learning without Tutor's Assistance

Referring to Figure 3, most learners (46.7%) indicated that *they possess a significantly low level of motivation in the absence of adequate tutor support throughout their online sessions*. The research conducted by Bostan et al. (2022) aligns with the present study, asserting that learner motivation is a crucial element in online sessions.

In the absence of adequate instructor support, 28.7% of students indicated experiencing a high degree of stress, while 27.9% reported a very high level of stress during online learning. Therefore, *adequate tutor support is a crucial element in alleviating learners' stress levels*. The research conducted by Byrne et al. (2020) and Zheng et al. (2021) corroborates the current study, which asserts that stress impacts learners during online sessions.

No.	Sub variables	Percentage of Learners						
		Very Low	Low	Medium	High	Very High	Total of agreement (M, H and VH)	Interpretation
1	Level of motivation	46.7%	24.3%	27.6%	1.5%	0%	29.1%	Low
2	Level of stress	0.7%	2.6%	40.1%	28.7%	27.9%	96.7%	High

Figure 3: Percentage response of learners on the psychological impact of online learning

4.4 Results of Correlation Analyses

The results of the correlation analyses are shown below:

		Adoption of Online Learning
Content Assimilation	Pearson Correlation	.493**
	Sig. (2-tailed)	.000
	N	373
Concentration Problems	Pearson Correlation	.506**
	Sig. (2-tailed)	.000
	N	373
Versatility with Online Environment	Pearson Correlation	.438**
	Sig. (2-tailed)	.000
	N	373
Language and Content	Pearson Correlation	.535**

Difficulties	Sig. (2-tailed)	.000
	N	373
Internet Connectivity and Computer Problems	Pearson Correlation	.164*
	Sig. (2-tailed)	.332
	N	373
Financial Problems	Pearson Correlation	.497**
	Sig. (2-tailed)	.000
	N	373
Degree of Joy and Enthusiasm	Pearson Correlation	.628**
	Sig. (2-tailed)	.000
	N	373
Degree of Anxiety & Depression	Pearson Correlation	.428**
	Sig. (2-tailed)	.000
	N	373

As can be observed, the results of this research were conclusive with one exception. All the independent variables except "Internet Connectivity and Computer Problems" are strongly related to the dependent variable (Adoption of Online Learning) at $P < 0.05$ and r values ranging between 0.428 to 0.628. This confirms that all the factors discussed have a strong influence on adoption of online learning.

5. Summary of Key Findings

This study points to several challenges experienced by Online Distance Learning (ODL) students both with and without the assistance of their tutors. The findings are quite insightful and revealing. The following aspects have a very good correlation with the adoption of online learning:

Content Assimilation
Concentration Problems
Versatility with Online Environment
Language and Content Difficulties
Internet Connectivity and Computer Problems
Financial Problems
Degree of Joy and Enthusiasm
Degree of Anxiety & Depression

6. Conclusion

This study aimed to evaluate the efficacy, obstacles, and psychological effects of implementing online learning. This study sought to ascertain the influence of tutor help on the efficacy, obstacles, and psychological effects associated with the adoption of online learning at the Open University of Mauritius. The research employed positivist and deductive methodology. A structured questionnaire was developed for the study plan, targeting 373 learners. The study's findings were partially conclusive, indicating that the independent variables—content assimilation, attention difficulties, adaptability to the online environment, language and content challenges, budgetary constraints, levels of joy and enthusiasm, and levels of worry and depression—received validation.

7. Recommendations

Based on the study findings, the following recommendations are proposed:

1. Efficacy of online learning

Digital instructional resources require clear and concise language tailored for the average learner. Content designers responsible for creating course materials must develop engaging instructional tools. The manuals and tutorial slides must be written in accessible language, suited to the understanding of the average learner. Tutors should employ visual aids in their tutorials to augment learners' focus and retention. Visual aids may encompass videos as well. Nevertheless, the movie must be concise, precise, and relevant to the topic.

The traditional approach to online training is becoming outdated. To augment happiness and delight, the University should offer its students greater flexibility in learning options. Gamification is a novel and widespread teaching strategy that eradicates tedium and fosters involvement. Tutors can enhance online learning experiences for students by including puzzles and quizzes in the course content. Gamification will augment the presentation of course content, rendering it a more captivating and dynamic experience for online learners. Incentivising learners during online sessions with gamification techniques, such as badges, rewards, and certifications, will augment their motivation.

2. Internet Connectivity

In the modern context, a rapid and reliable Internet connection is a crucial asset for students participating in online education. The University can provide students with a USB dongle for wireless Internet access to resolve the problem of inconsistent connectivity. Students will thus have access to instructional resources and can study from any location.

3. Counseling services for learners

This study effectively detected the psychological effects experienced by learners during online sessions. A significant proportion of learners endure stress, despair, and anxiety.

The Open University ought to establish a counselling section or service that is available either in person or online. This part can promote debates among psychologists on topics related to education. Students will gain substantial benefits from these talks. Psychologist can conduct individual consultations with students facing difficulties in their academic endeavours. Effective counselling is essential for the prompt detection of these concerns. Challenges may include failure to meet assignment deadlines and more complex issues, such as inadequate financial resources to cover program expenditures.

The Exam Unit can identify students who struggle to pass a module. Particularly those undertaking a second resit for the same module should be encouraged to consult a psychologist for appropriate counselling.

4. Appropriate virtual learning environments

Learners often encounter sensations of confusion, loneliness, and isolation, especially when part of big groups (100+). The tutor's duty is to analyse such problems and cultivate a positive learning atmosphere. They ought to promote collaboration. Consequently, they can organise their classrooms to facilitate collaborative work among learners in smaller groups. Utilising break-out rooms and online discussion forums will benefit learners by allowing them to express themselves, share their ideas, and receive the necessary attention. Consequently, a tutor will ultimately motivate students to convey their insights to their peers. The tutor will take the chance to engage with the most reticent student in the class.

Thorough planning is necessary to prevent an excessive number of sessions in a single day. Students suggested incorporating ten-minute pauses between instructional sessions. These little intermissions will be advantageous for them. It can be utilised for breathing and stretching exercises.

5. Utilisation of AI chatbot

The University can employ an AI chatbot to improve the educational experience. The latter is progressively gaining prominence in the field of education. The tutors will utilise chatbots to interact with the learners, similar to a personalised teaching environment. They will notify learners regarding deadlines, course prerequisites, and any alterations. The University may employ this digital companion to facilitate significant interactions with students, deliver tailored instruction, and promptly respond to their questions, instead of depending on a compilation of FAQs.

Thus, this AI technology will enhance the educational experience of the learners. It will enhance learner motivation, alleviate worries, diminish stress levels, and foster a greater sense of support among pupils.

References

Abuhammad, S. (2020). Barriers to distance learning during the COVID-19 outbreak: A qualitative review from parents' perspective. *Heliyon*, *6*(11). https://doi.org/10.1016/j.heliyon.2020.e05482

Bostan, C. M., Apostol, A.-C., Andronic, R.-L., Stanciu, T., & Constantin, T. (2022). Type of goals and perceived control for goal achievement over time. the mediating role of motivational persistence. *Acta Psychologica*, *231*, 103776. https://doi.org/10.1016/j.actpsy.2022.103776

Bowles, A. R., & Healy, A. F. (2003). The effects of grouping on the learning and long-term retention of spatial and temporal information. *Journal of Memory and Language*, *48*(1), 92–102. https://doi.org/10.1016/s0749-596x(02)00520-x

Bui, D. T., Nhan, T. T., Dang, H. T., & Phung, T. T. (2022). Online learning experiences of secondary school students during COVID-19 – dataset from Vietnam. *Data in Brief*, *45*, 108662. https://doi.org/10.1016/j.dib.2022.108662

Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., & Zheng, J. (2020). The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Research*, *287*, 112934. https://doi.org/10.1016/j.psychres.2020.112934

Chaker, R., Bouchet, F., & Bachelet, R. (2022). How do online learning intentions lead to learning outcomes? the mediating effect of the Autotelic Dimension of flow in a MOOC. *Computers in Human Behavior*, *134*, 107306. https://doi.org/10.1016/j.chb.2022.107306

Choi, Y., & Hong, S. (2020). Qualitative and quantitative analysis of patent data in nanomedicine for bridging the gap between research activities and practical applications. *World Patent Information*, *60*, 101943. https://doi.org/10.1016/j.wpi.2019.101943

Dong, C., Cao, S., & Li, H. (2020). Young Children's online learning during COVID-19 pandemic: Chinese parents' beliefs and attitudes. *Children and Youth Services Review*, *118*, 105440. https://doi.org/10.1016/j.childyouth.2020.105440

Dsouza, R., & Bertocci, G. (2010). Development and validation of a computer crash simulation model of an occupied adult manual wheelchair subjected to a frontal impact. *Medical Engineering & Physics*, *32*(3), 272–279. https://doi.org/10.1016/j.medengphy.2009.01.008

Feldman-Maggor, Y., Blonder, R., & Tuvi-Arad, I. (2022). Let them choose: Optional assignments and online learning patterns as predictors of success in online general chemistry courses. *The Internet and Higher Education*, *55*, 100867. https://doi.org/10.1016/j.iheduc.2022.100867

Frontera, J. A., Sabadia, S., Yang, D., de Havenon, A., Yaghi, S., Lewis, A., Lord, A. S., Melmed, K., Thawani, S., Balcer, L. J., Wisniewski, T., Galetta, S. L., Agarwal, S., Andino, A., Arena, V., Baskharoun, S., Bauman, K., Bell, L., Berger, S., … Zhu, Y. (2022). Life stressors significantly impact long-term outcomes and post-acute symptoms 12-months after COVID-19 hospitalization. *Journal of the Neurological Sciences*, *443*, 120487. https://doi.org/10.1016/j.jns.2022.120487

Gehle, M., Trautner, M., & Schwinger, M. (2023). Motivational self-regulation in children with mild learning difficulties during middle childhood: Do they use motivational regulation strategies effectively? *Journal of Applied Developmental Psychology*, *84*, 101487. https://doi.org/10.1016/j.appdev.2022.101487

Gellisch, M., Morosan-Puopolo, G., Wolf, O. T., Moser, D. A., Zaehres, H., & Brand-Saberi, B. (2023). Interactive teaching enhances students' physiological arousal during online learning. *Annals of Anatomy - Anatomischer Anzeiger*, *247*, 152050. https://doi.org/10.1016/j.aanat.2023.152050

Gosselin, P., Castonguay, C., Goyette, M., Lambert, R., Brisson, M., Landreville, P., & Grenier, S. (2022). Anxiety among older adults during the COVID-19 pandemic. *Journal of Anxiety Disorders*, *92*, 102633. https://doi.org/10.1016/j.janxdis.2022.102633

Guo, C., & Wan, B. (2022). The digital divide in online learning in China during the COVID-19 pandemic. *Technology in Society*, *71*, 102122. https://doi.org/10.1016/j.techsoc.2022.102122

Hernández-Sellés, N., Pablo-César Muñoz-Carril, & González-Sanmamed, M. (2019). Computer-supported Collaborative Learning: An Analysis of the relationship between interaction, emotional support and online collaborative tools. *Computers & Education*, *138*, 1–12. https://doi.org/10.1016/j.compedu.2019.04.012

Holubnycha, L., Khodakovska, O., Besarab, T., Dolgusheva, O., & Malieieva, T. (2021). Psychological impact of online learning during covid-19 pandemic on students' mental health as Life Quality Basis. *Revista Amazonia Investiga*, *10*(47), 70–80. https://doi.org/10.34069/ai/2021.47.11.8

Hossain, Md. J., Ahmmed, F., Rahman, S. M. A., Sanam, S., Emran, T. B., & Mitra, S. (2021). Impact of online education on fear of academic delay and psychological distress among university students following one year of covid-19 outbreak in Bangladesh. *Heliyon*, *7*(6). https://doi.org/10.1016/j.heliyon.2021.e07388

Huan-Niemi, E., Rikkonen, P., Niemi, J., Wuori, O., & Niemi, J. (2016). Combining quantitative and qualitative research methods to foresee the changes in the Finnish agri-food sector. *Futures*, *83*, 88–99. https://doi.org/10.1016/j.futures.2016.03.007

Hussain, R., Hassali, M. A., & Babar, Z.-U.-D. (2019). Quantitative methods in pharmacy practice research. *Encyclopedia of Pharmacy Practice and Clinical Pharmacy*, 22–28. https://doi.org/10.1016/b978-0-12-812735-3.00603-8

Karbakhsh Ravari, A., Farokhzadian, J., Nematollahi, M., Miri, S., & Foroughameri, G. (2020). The effectiveness of a time management workshop on job stress of nurses working in emergency departments: An experimental study. *Journal of Emergency Nursing*, *46*(4). https://doi.org/10.1016/j.jen.2020.03.013

Khoury, O. (2022). Perceptions of student-centered learning in online translator training: Findings from Jordan. *Heliyon*, *8*(6). https://doi.org/10.1016/j.heliyon.2022.e09644

Linjawi, A. I., & Alfadda, L. S. (2018). Students’ perception, attitudes, and readiness toward online learning in dental education in Saudi Arabia: A cohort study. *Advances in Medical Education and Practice*, *Volume 9*, 855–863. https://doi.org/10.2147/amep.s175395

Li, H.-S., Wang, X.-W., Nan, H., & Liu, M. (2021). Application of a sampling-based method for estimation of cumulative failure probability functions of mechanisms. *Mechanism and Machine Theory*, *155*, 104050. https://doi.org/10.1016/j.mechmachtheory.2020.104050

Malysheva, O., Tokareva, E., Orchakova, L., & Smirnova, Y. (2022). The effect of online learning in Modern History Education. *Heliyon*, *8*(7). https://doi.org/10.1016/j.heliyon.2022.e09965

Mohd Basar, Z., Mansor, A. N., Jamaludin, K. A., & Alias, B. S. (2021). The effectiveness and challenges of online learning for secondary school students – A case study. *Asian Journal of University Education*, *17*(3), 119. https://doi.org/10.24191/ajue.v17i3.14514

Penrod, D., Shaw, T., Nash, J., Dierkes, M., & Collins, S. (2022). Community college students' perspectives on online learning during COVID-19 and factors related to success. *Teaching and Learning in Nursing*, *17*(3), 267–271. https://doi.org/10.1016/j.teln.2022.01.012

Richardson, C., & Gradisar, M. (2020). Perfectionism and insomnia in adolescents: The role of vulnerability to stress and gender. *Journal of Adolescence*, *85*(1), 70–79. https://doi.org/10.1016/j.adolescence.2020.10.003

Schroeders, U., & Wilhelm, O. (2011). Computer usage questionnaire: Structure, correlates, and gender differences. *Computers in Human Behavior, 27*(2), 899–904. https://doi.org/10.1016/j.chb.2010.11.015

Shukor, N. A., Tasir, Z., & Van der Meijden, H. (2015). An examination of online learning effectiveness using data mining. *Procedia - Social and Behavioral Sciences, 172*, 555–562. https://doi.org/10.1016/j.sbspro.2015.01.402

Singh, S., Downie, L. E., & Anderson, A. J. (2021). Do blue-blocking lenses reduce eye strain from extended screen time? A double-masked randomized controlled trial. *American Journal of Ophthalmology, 226*, 243–251. https://doi.org/10.1016/j.ajo.2021.02.010

Spinhoven, P., Hoogerwerf, E., van Giezen, A., & Greeven, A. (2022). Mindfulness-based cognitive group therapy for treatment-refractory anxiety disorder: A pragmatic randomized controlled trial. *Journal of Anxiety Disorders, 90*, 102599. https://doi.org/10.1016/j.janxdis.2022.102599

Su, W., Luo, D., Zhang, C., & Zeng, S. (2022). Evaluation of online learning platforms based on probabilistic linguistic term sets with self-confidence multiple attribute group decision making method. *Expert Systems with Applications, 208*, 118153. https://doi.org/10.1016/j.eswa.2022.118153

Subzar, M., Ahmad Lone, S., Aslam, M., Hussein AL-Marshadi, A., & Maqbool, S. (2023). Exponential ratio estimator of the median: An alternative to the regression estimator of the median under stratified sampling. *Journal of King Saud University - Science, 35*(3), 102536. https://doi.org/10.1016/j.jksus.2022.102536

Tang, Y., Tseng, H., & Tang, X. (2022). The impact of information-seeking self-efficacy and online learning self-efficacy on students' performance proficiency. *The Journal of Academic Librarianship, 48*(5), 102584. https://doi.org/10.1016/j.acalib.2022.102584

Valentín-Sívico, J., Canfield, C., Low, S. A., & Gollnick, C. (2023). Evaluating the impact of broadband access and internet use in a small underserved rural community. *Telecommunications Policy, 47*(4), 102499. https://doi.org/10.1016/j.telpol.2023.102499

Wang, Y., Cao, Y., Gong, S., Wang, Z., Li, N., & Ai, L. (2022). Interaction and learning engagement in online learning: The mediating roles of online learning self-efficacy and academic emotions. *Learning and Individual Differences, 94*, 102128. https://doi.org/10.1016/j.lindif.2022.102128

Yamamori, Y., & Robinson, O. J. (2023). Computational Perspectives on Human Fear and anxiety. *Neuroscience & Biobehavioral Reviews*, *144*, 104959. https://doi.org/10.1016/j.neubiorev.2022.104959

Yao, Y., Wang, P., Jiang, Y., Li, Q., & Li, Y. (2022). Innovative Online Learning Strategies for the successful construction of student self-awareness during the COVID-19 pandemic: Merging Tam with TPB. *Journal of Innovation & Knowledge*, *7*(4), 100252. https://doi.org/10.1016/j.jik.2022.100252

Yesilot, S. B., Yesil Demirci, P., & Eskimez, Z. (2022). The role of intolerance of uncertainty and anxiety sensitivity on nursing students' depression, anxiety, and stress levels. *Nurse Education in Practice*, *65*, 103487. https://doi.org/10.1016/j.nepr.2022.103487

Yu-Fong Chang, J., Wang, L.-H., Lin, T.-C., Cheng, F.-C., & Chiang, C.-P. (2021). Comparison of learning effectiveness between physical classroom and online learning for dental education during the COVID-19 pandemic. *Journal of Dental Sciences*, *16*(4), 1281–1289. https://doi.org/10.1016/j.jds.2021.07.016

Zhang, G., Zhu, Z., Zhu, S., Liang, R., & Sun, G. (2022). Towards a better understanding of the role of visualization in Online learning: A review. *Visual Informatics*, *6*(4), 22–33. https://doi.org/10.1016/j.visinf.2022.09.002

Zhang, S., Ma, R., Wang, Z., Li, G., & Fa, T. (2022). Academic self-concept mediates the effect of online learning engagement on Deep Learning in online courses for Chinese nursing students: A cross-sectional study. *Nurse Education Today*, *117*, 105481. https://doi.org/10.1016/j.nedt.2022.105481

Zheng, R., Zhou, Y., Qiu, M., Yan, Y., Yue, J., Yu, L., Lei, X., Tu, D., & Hu, Y. (2021). Prevalence and associated factors of depression, anxiety, and stress among Hubei pediatric nurses during COVID-19 pandemic. *Comprehensive Psychiatry*, *104*, 152217. https://doi.org/10.1016/j.comppsych.2020.152217

Zulfikar, A. F., Muhidin, A., Pranoto, Suparta, W., Trisetyarso, A., Abbas, B. S., & Kang, C. H. (2019). The effectiveness of online learning with Facilitation Method. *Procedia Computer Science*, *161*, 32–40. https://doi.org/10.1016/j.procs.2019.11.096