SYSTEMATIC REVIEW

REVISED Synchronous online learning during movement control order in higher education institutions: a systematic review [version 2; peer review: 2 approved]

Yee Wan Lee[1], Magiswary Dorasamy [ID][1], Abdul Aziz Bin Ahmad[1], Manimekalai Jambulingam[2], Peik Foong Yeap [ID][3], Sharbani Harun[4]

[1]Faculty of Management, Multimedia University, Cyberjaya, Selangor, 63100, Malaysia
[2]Taylor's University, Subang Jaya, Selangor, 47500, Malaysia
[3]University of Newcastle, Callaghan, NSW, 2308, Australia
[4]Technology Park Malaysia, Kuala Lumpur, Wilayah Persekutuan, 57000, Malaysia

Abstract

Background: Higher education institutions (HEI) are not spared from the coronavirus disease 2019 (COVID-19) pandemic. The closure of campuses because of the movement control order (MCO) to mitigate the spread of the COVID-19 has forced HEIs to adopt online learning, especially synchronous online learning (SOL). Although teaching and learning can be continued via SOL, retaining students' interest and sustaining their engagement have not been sufficiently explored. This study presents a systematic review of the research pertaining to SOL associated with students' interest and engagement in HEIs during the MCO environment.

Methods: Five major online databases, i.e., EBSCOhost, Science Direct, Emerald, Scopus and Springer were searched to collect relevant papers published between 1st January 2010 to 15th June 2021 including conference proceedings, peer-reviewed papers and dissertations. Papers written in the English language, based in full-fledged universities, and with these five keywords: (i) synchronous online learning, (ii) engagement, (iii) interest, (iv) MCO/Covid-19 and (v) HEI, were included. Papers focussing on synchronous and asynchronous online learning in schools and colleges were excluded. Each paper was reviewed by two reviewers in order to confirm the eligibility based on the inclusion and exclusion criteria.

Results: We found 31 papers of which six papers were related to SOL, engagement and interest in HEIs in the MCO environment. Our review presents three major findings: (i) limited research has been conducted on SOL associated with students' engagement and interest, (ii) studies related to the context of HEIs in the MCO environment are limited, and (iii) the understanding of the new phenomena through qualitative research is insufficient. We highlight the SOL alignment with students'

Open Peer Review

Reviewer Status ✓ ✓

	Invited Reviewers	
	1	**2**
version 2 (revision) 19 Nov 2021		✓ report
		↑
version 1 18 Oct 2021	✓ report	? report

1. **Manjula Nagarajan**, Thiagarajar School of Managemnet, Madurai, India

2. **Jessica Sze Yin Ho** [ID], Heriot-Watt University, Putrajaya, Malaysia

Any reports and responses or comments on the article can be found at the end of the article.

engagement, interest, style preference, learner interaction
effectiveness, behavior and academic performance.
Conclusions: We believe that the findings of this study are timely and
require attention from the research community.

Keywords
Interest, Engagement, Synchronous Online Learning, Higher
Education Institution, Movement Control Order, Pandemic, Covid-19,
Malaysia

This article is included in the Research Synergy
Foundation gateway.
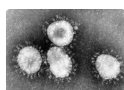
This article is included in the Coronavirus
collection.

Corresponding authors: Yee Wan Lee (1171400703@student.mmu.edu.my), Magiswary Dorasamy (magiswary.dorasamy@mmu.edu.my
)

> **_REVISED_** **Amendments from Version 1**
>
> Based on the recommendations of reviewers, I have made the following changes in the text of manuscript: I have included a column of country-wise analysis for all the 31 identified papers in Table 5 as it will give an idea as to which continent had contributed to the similar area of research and would also pave the way to increase the scope of the research. Secondly, I have strengthened the manuscript by providing the limitation of terminologies used in the online database search process. The inclusion of this limitation in the enhanced manuscript will be helpful for the future research. Thirdly, I have strengthened the discussion on the limitations based on the identified 31 research papers. This will enhance the quality of research gaps discussion. Lastly, I have included the discussion of theoretical and practical implications of this research in the sections of findings and conclusion.
>
> **Any further responses from the reviewers can be found at the end of the article**

Introduction

The Malaysian online learning movement started in the 1990s with the objective of providing learners access to quality education and lifelong learning opportunity.[1] Despite the growing online learning trend, physical learning remains the mainstream learning mode for full-time undergraduate students because most of the Malaysian universities' infrastructures, facilities and program structures are built for physical teaching and learning.[2] However, the eruption of the coronavirus disease 2019 (COVID-19) pandemic in 2019 changed this norm. The enforcement of movement control order (MCO) in Malaysia has pushed universities towards online learning. Therefore, synchronous online learning (SOL) has been adopted as a temporary solution in the time of the pandemic to ensure the continuity of academic activities. Even though literature abounds regarding online learning for adult learners in the normal environment, synchronous online learning (SOL) for undergraduate students during the COVID-19 pandemic is a new phenomenon that warrants the attention of research community. Therefore, a systematic literature reviews will help the researchers to identify the research gaps in this new environment.

Synchronous online learning (SOL)

SOL is a form of online learning where teaching and learning occur simultaneously and at the same place.[3] In SOL, students and instructors can login remotely from any location in the world and concurrently participate in the learning process.[4,5] The advancement of online learning technologies, such as audio, video, and text, has allowed instant feedback and real-time interaction between students, instructors and fellow students.[6-11] These features of SOL that resemble physical learning are well accepted by students.[12,13] Despite the benefits of live session, immediacy and real-time guidance and feedback, SOL has its limitations.[6,14,15] For instance, technical difficulties, availability of electronic devices, internet connection, interface and bandwidth and students' interest and engagement are issues related to SOL in higher education institutions (HEIs) in the MCO environment.[16]

Engagement

Engagement is referred to as the interaction between the time, effort and relevant resources invested to optimize student's experience, learning outcomes and performance.[17] Engagement is also related to student's attitudes towards the learning process and psychological involvement in the learning activities to attain positive learning outcomes, such as satisfaction, achievement and performance.[18,19] Behavioral, cognitive and emotional engagement are the three main engagement components.[20] Behavioral engagement requires students to comply with the behavioral norms, where students do not demonstrate disruptive or negative behavior. Students with positive behavioral engagement will attend classes and participate enthusiastically in the learning process. Next, students with emotional engagement demonstrate interest and enjoyment in the learning process. Lastly, students with cognitive engagement will go the extra mile in the learning process to perform beyond expectation.

Interest

Interest is the underlying psychological factor of being engaged or engrossed in an activity and a guiding factor in energising learning and academic performance.[21,22] Next, continuing interest requires students to endure and reengage in the learning activities over time.[23] Therefore, educational activities that meet individual students' needs can catch students' attention, such as by varying the novelty, complexity and incongruity of visual stimuli.[21,22,24] Nevertheless, the heterogeneity of individual interest and the large class size have made these tasks challenging.[25] Hence, creating situational interest in the learning process is the first step in developing students' individual interest[26,27] because students with a positive individual interest are highly engaged and attentive to achieve good academic performance as individual interest is a psychological behavior of positive affect and persistency in the learning process.[28,29] When students' individual interest matches the specific contextual affordances, students will be focused and enjoy learning. A study suggests that interest will develop into a self-sustained and well-developed interest with the passage of time.[21]

Given this backdrop, the three research questions for this study are as follows:

1. Do research gaps in SOL pertaining to students' engagement and interest in HEIs in the MCO environment exist?

2. What are the limitations in the current research within SOL in HEIs in the MCO environment?

3. What is the conceptual framework for SOL pertaining to students' engagement and interest in HEIs in the MCO environment?

The objectives of this proposal are as follows:

1. To identify research gaps in SOL pertaining to students' engagement and interest in HEIs in the MCO environment.

2. To understand the limitations of the current research within SOL in HEIs in the MCO environment.

3. To develop a conceptual framework for SOL pertaining to students' engagement and interest in HEIs in the MCO environment.

Methods
Institutional review board statement
This study was approved by the Research Ethical Committee (REC) of Multimedia University (EA2742021).

Study design
This paper was designed to present a literature review, a research gap analysis and insights into SOL pertaining to undergraduate students' engagement and interest in HEIs in the MCO environment. The five stages of literature review proposed by[30] were used in this process:

Stage 1: Planning the review

Stage 2: Identifying and evaluating studies

Stage 3: Extracting and synthesising data

Stage 4: Reporting descriptive findings

Stage 5: Utilising the findings to inform research and practice
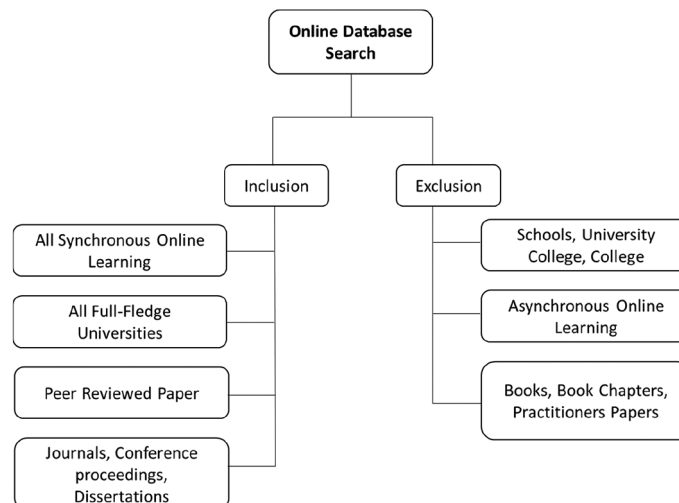
Figure 1. Paper selection process flow.

Table 1. Search strategy.

Synchronous online learning (SOL)	Synchronous online learning (SOL)	Synchronous online learning (SOL)	Synchronous online learning (SOL)	Synchronous online learning (SOL)	Synchronous online learning (SOL)	Date search
Engagement		Engagement	Engagement	Engagement	Engagement	1 June 2021 to 15 June 2021
	Interest	Interest	Interest	Interest	Interest	1 June 2021 to 15 June 2021
			Coronavirus disease 2019 (COVID-19)	Coronavirus disease 2019 (COVID-19)	Coronavirus disease 2019 (COVID-19)	1 June 2021 to 15 June 2021
				Movement control order (MCO)	Movement control order (MCO)	1 June 2021 to 15 June 2021
					Higher education institutions (HEIs)	1 June 2021 to 15 June 2021

This review is reported in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) reporting guidelines.[62]

Stage 1. Planning the review

The main purpose of this review is to identify research gaps in terms of theories, factors, methods and processes pertaining to SOL and the engagement and interest elements in HEIs in the MCO environment.

Stage 2. Identifying and evaluating studies

The main focus of this study is SOL. Therefore, papers on asynchronous learning were excluded in the selection and evaluation process. Nevertheless, the identification and evaluation were hampered because not all the papers used the term synchronous and asynchronous explicitly.

Selection process

Five major online databases, namely EBSCOhost, Science Direct, Emerald, Scopus and Springer were searched to collect relevant papers published between 1st January 2010 to 15th June 2021 including conference proceedings, peer-reviewed papers and dissertations. Papers written in the English language and based in full-fledged universities with these five keywords: (i) synchronous online learning, (ii) engagement, (iii) interest, (iv) MCO/COVID-19 and (v) HEI, were included in the selection process. Papers that focused on synchronous and asynchronous online learning in schools and colleges were excluded. The limitation of this selection process strategy is that other terminologies used for online learning such as hybrid-classroom, flipped-classroom, distance learning, E-learning, Massive Open Online Course (MOOC) and etc. were excluded. Similarly, terms such as lockdown, circuit-breaker and etc. were not included in the search process. Figure 1 presents the paper selection process. Next, each paper was reviewed by two reviewers collectively in order to confirm the eligibility based on the inclusion and exclusion criteria.

Search strategy

The search strategy was to sift through papers that discuss SOL pertaining to students' engagement and interest in the time of MCO using the combination of keywords (Table 1). However, the search strategy that based on the five identified keywords in the selection process may lead to publication bias risk. Therefore, future researchers may expand the selection of keywords in order to reduce the risk of missing some relevant articles.

Table 2. Paper search focus areas.

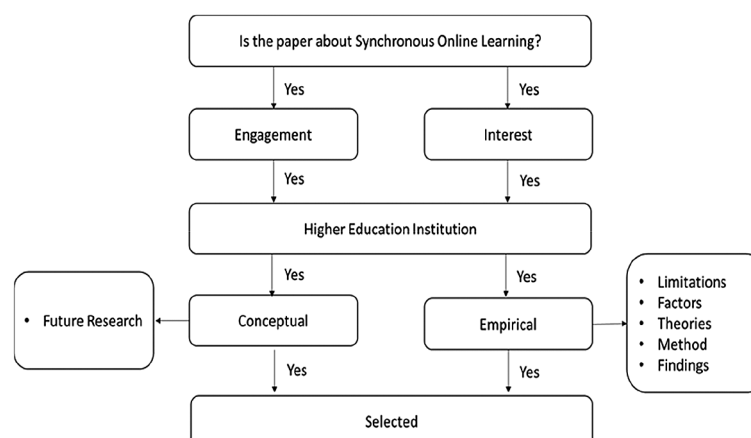| Focus areas	Theory	Method	Factor	Limitation
Definition	What theory/ theories were used in this research?	What research method/ methods were used to collect research data in this research?	What factor/factors were used to explain the research?	What were the limitation/ limitations of this research?

Figure 2. Data extraction and synthesis process.

Stage 3. Extracting and synthesising data

In this extraction process, only conceptual and empirical papers associated with SOL, engagement and interest in HEIs under MCO were selected for synthesis. Further, data on theories, methods, factors and limitations of the selected papers were reviewed and evaluated. Table 2 presents the focus areas in extracting and synthesising data from the selected papers.

Figure 2 presents the papers extraction process.

The Transfield stages 4 and 5 are presented in the following sections.

Results

Reporting descriptive findings

Table 3 presents the online databases search result. A total of 21,431 papers are listed as "synchronous online learning". The number dropped to 4,970 (23%) after adding the word "engagement" and dropped further to 2,020 (9.4%) after adding the word "interest".

We examined 31 papers. However, as shown in Table 4, only six out of the 31 papers are associated with SOL in HEI in the MCO environment. Further, only two out of these six papers are related to engagement, and no paper is related to the interest element.

Table 5 summarizes the theories, methods and factors used in these 31 papers. Only 8 papers (26%) used qualitative methods, 8 papers (26%) are associated with SOL, 5 papers (16%) are related to engagement, no paper (0%) is related to interest, 11 papers (35%) are related to HEI and 19 papers (61%) are related to MCO. However, only 2 papers (6%) were associated to SOL, engagement, HEI and MCO. Therefore, the research in the area of student's engagement and interest, particularly that associated with SOL in HEI in the MCO environment.

Table 6 presents the plotting of 31 papers to engagement, interest, synchronous online learning (SOL), movement control order (MCO) and higher education institutions (HEIs).

Table 5 and Table 6 show that, student's engagement and interest associated with SOL in HEIs in the MCO environment is insufficiently researched. The online databases search results in Figure 3 also shows that only two papers are relevant to our research.

Discussion

Table 7 presents the summary of the six papers related to synchronous online learning (SOL) in higher education institutions (HEIs) in the movement control order (MCO) environment.

Based on the above summary, research in the areas of undergraduate students' engagement and interest in synchronous online learning during movement control order warrant further investigation. In-depth research into these areas will help the research community to offer practical solutions to synchronous online learning during MCO for undergraduate students who are used to physical face-to-face learning to increase learning effectiveness during the time of a crisis, such as a Coronavirus pandemic crisis. Next, this research will also bridge the theoretical gap where new or enhanced conceptual framework can be introduced.

Research gaps

Three major research gaps were identified:

Research gap 1: SOL in HEI during MCO context

Only six papers[31–36] are related to HEI in the MCO environment. Therefore, this new phenomenon warrants further investigation by the research community.

Research gap 2: Engagement and interest elements

Only two papers[31,32] related to engagement are associated with SOL in the MCO environment. The study on SOL associated with engagement and interest is clearly insufficient. Moreover, Paper 1[31] focused only on students' cognitive engagement, such as attitude, affect, and motivation, whereas Paper 2[32] focused on accounting lecturers' reflection

Table 3. Summary of keyword search result.

No	Online database	Synchronous online learning	Synchronous online learning Engagement	Synchronous online learning Interest	Synchronous online learning Engagement Interest	Synchronous online learning Engagement Interest Covid-19	Synchronous online learning Engagement Interest Covid 19 MCO	Synchronous online learning Engagement Interest Covid-19 MCO HEI	Date search
1	EBSCOhost	263	26	1	0	0	0	0	6th June 2021
2	Science direct	11659	1808	3391	1078	67	17	7	6th June 2021
3	Scopus	393	22	0	0	0	0	0	6th June 2021
4	Springer	8116	2251	360	159	14	8	7	6th June 2021
5	Emerald	1000	863	0	783	72	6	6	6th June 2021
	Grand total	21431	4970	3752	2020	153	31	20	

Table 4. Data extraction and synthesis process.

No	Combination of keywords	Frequency
1	Synchronous online learning (SOL) + Higher education institutions (HEIs)	6
2	Synchronous online learning (SOL) + Higher education institutions (HEIs) + Movement control order (MCO)	6
3	Synchronous online learning (SOL) + Higher education institutions (HEIs) + Movement control order (MCO) + Engagement	2
4	Synchronous online learning (SOL) + Higher education institutions (HEIs) + Movement control order (MCO) + Interest	0
5	Synchronous online learning (SOL) + Higher education institutions (HEIs) + Movement control order (MCO) + Engagement + Interest + Qualitative methods	0
6	Qualitative methods	7

regarding students' engagement during synchronous and asynchronous online classes. Engagement can be categorized into cognitive, behavioral and emotional engagement.[20] A holistic view on students' engagement should include these three dimensions. Next, students' interest in learning via SOL will affect the quality of engagement. Nevertheless, interest as a factor associated with SOL in HEI in the MCO environment has not been researched intensively. Therefore, the inclusion of interest warrants the attention of the research community.

Research gap 3: Method

In total, seven qualitative research methods were identified from the 31 papers. Only one paper used case study method. SOL in HEIs in the MCO environment is a new phenomenon that may require a more in-depth investigation method, such as a case study method to gain better insights.

Limitations in current studies within synchronous online learning (SOL) in higher education institutions (HEIs) in the movement control order (MCO) environment

Table 8 presents the following limitations of the six papers pertaining to SOL associated with engagement and interest in HEI in the MCO environment.

Four limitations were identified from the 31 selected papers:

i.   These papers mainly focused on the cognitive dimension of engagement. Therefore, the inclusion of behavioral and emotional dimensions may be important for a holistic understanding of students' engagement. Next, engagement is a personal factor. Therefore, investigating students directly to gauge their engagement level is important.

ii. Few papers related to the interest element pertaining to SOL in the MCO environment exist. Interest is closely associated with engagement in the learning process. Therefore, interest must be included in the study of SOL in HEI in the MCO environment.

iii. An in-depth understanding of how students are engaged, and their interest sustained through case study research will help complement the findings derived from quantitative studies pertaining to SOL associated with engagement and interest in HEI in the MCO environment.

iv. Based on the identified 31 papers, only 6 papers were related to the targeted research areas. The rest of the 25 papers were irrelevant to the research areas. For instance, student's anxiety level during MCO, the used of 5G technology in online education, proficiency usage of various online teaching platforms and devices and etc.

Therefore, Figure 4 is the conceptual framework for students' engagement and interest pertaining to SOL in HEI in the MCO environment.

Table 5. Summary of 31 selected papers. SOL = synchronous online learning; MCO = movement control order; HEI = higher education institution.

No	Citation	Author (Year)	Theory	Method	Factor	Limitation	Has the paper discussed about these keywords?				
							SOL	Engagement	Interest	MCO	HEIs
1	31	Aguilera-Hermida (2020)		Quantitative	Attitude, Affect, Motivation; Perceived behavioral control Cognitive engagement	No standardized questions were asked. Only students from public universities were included. Study excluded students who did not have access to the Internet.	x	x		x	x
2	33	Srivastava et al. (2021)		Quantitative	Anxiety level		x			x	x
3	37	Darling-Aduana (2021)		Mixed method	Authentic work (Course videos, assignments, practice problems, and assessments)	Components of authentic work, such as communication and interaction with peers, that were not facilitated by the online course system evaluated					x
4	38	Bogdan et al. (2021)		Qualitative	Protective and precautionary behaviors, social connections, and self-efficacy						
5	39	Li et al. (2020)			5G, AI, AR					x	
6	40	Corbin (2020)	The Stairway to Lifetime Fitness, Health, and Wellness		Conceptual physical education (CPE)					x	
7	42	Tyerman, Luctkar-Flude, & Baker (2021)		Qualitative						x	
8	43	Constantin et al (2021)		Qualitative	Participatory Design (PD)			x		x	
9	44	Philippe et al. (2020)		Qualitative	Serious games, Simulations, Collaborative VR	lack of robust evaluation framework					
10	45	Thomas et al. (2021)	Behavioral lifestyle intervention	Experiment	Virtual reality, Interactive video feedback, Tailored intervention						
11	46	Shankar et al. (2021)			Technology adoption (customers, suppliers, employees, retailers)	Investigate the impact of technology on not just retail outcomes but also on the whole retail ecosystem				x	
12	47	Keswani, Brooks & Khoury (2020)			Supervision, Virtual mentoring, Virtual classroom, Didactic curriculum						
	48	Khodadad-Saryazdi (2021)		Qualitative	Adoption, Routinization, Implementation						

Table 5. *Continued*

No	Citation	Author (Year)	Theory	Method	Factor	Limitation	Has the paper discussed about these keywords?				
							SOL	Engagement	Interest	MCO	HEIs
14	49	Tessitore et al. (2021)		Systematic literature review		Deliberate exclusion of articles related to support from other sources					
15	41	Abdelgaffar (2021)		Qualitative							x
16	50	Applin & Flick (2021)			Public behaviors						
17	51	Fernandez-Álvarez et al. (2020)	Encyclopaedia								
18	52	Ironsi (2021)		Quantitative		Obtaining ethical consent from the participants was difficult as well and so the sample size was small.	x				
19	32	Ali, Narayan & Sharma (2020)	Engagement	Qualitative			x	x		x	x
20	53	Badiozaman, Leong & Wong (2020)		Quantitative	Online teaching and learning, mastering Google Classroom, cloud-based productivity tools, netiquette, cybersecurity	Small sample size - Digital Educator Series training, the accuracy of the description may be unique to this particular group of individuals.	x			x	
21	35	Tan (2020)		Quantitative	Motivation, Community of inquiry, cognitive presence and teaching presence and Learning performance.		x			x	x
22	36	Simoes et al. (2021)		Quantitative	Availability of resources, Virtual learning process, Performance of students		x			x	x
23	54	López et al. (2020)								x	
24	55	Kundu & Bej (2021)		Quantitative	Pedagogies, challenges faced		x	x		x	
25	56	Romero-Hall (2021)			Digital divide, Internet filtering policies, lack of research, Education reform, M-learning technology, Social media ethics						x
26	57	Caligiuri et al. (2020)								x	
27	58	Pacheco (2020)								x	
28	59	Moura, Nascimento & Ferreira (2021)		Conceptual						x	
29	34	Ismailov & Ono (2021)	Motivation, Self-Determination theory, Expectancy-value theory	Quantitative	Motivation	Study involved groups of mainly first-year Japanese students, and thus, the sample may have been rendered homogeneous	x	x		x	x
	60	Chang & Kuo (2021)	Cultural Historical activity theory		Interactions and interactivity (LMS)					x	x
	61	Leal Filho et al. (2021)		Quantitative						x	x

Table 6. Plotting of papers regarding engagement, interest, SOL (synchronous online learning), HEI (higher education institutions), and MCO (movement control order).

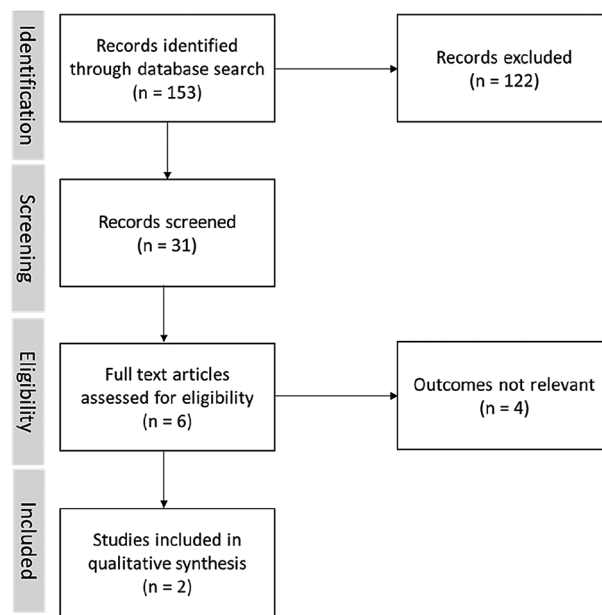| No	Author (Year)	Has the paper discussed about these keywords?				
		Synchronous online learning (SOL)	Engagement	Interest	Movement control order (MCO)	Higher education institutions (HEIs)
1	Aguilera-Hermida (2020)	x	x		x	x
2	Srivastava et al. (2021)	x			x	x
3	Darling-Aduana (2021)					x
4	Bogdan et al. (2021)					
5	Li et al. (2020)				x	
6	Corbin (2020)				x	
7	Tyerman, Luctkar-Flude, & Baker (2021)				x	
8	Constantin (2021)		x		x	
9	Philippe (2020)					
10	Thomas (2021)					
11	Shankar (2021)				x	
12	Keswani, Brooks, & Khoury (2020)					
13	Khodadad-Saryazdi (2021)					
14	Tessitore (2020)					
15	Abdelgaffar (2021)					x
16	Applin, & Flick (2021)					
17	Fernandez-Álvarez, (2020)					
18	Ironsi (2021)	x				
19	Ali, Narayan & Sharma (2020)	x	x		x	x
20	Badiozaman, Leong & Wong (2020)	x			x	
21	Tan (2020)	x			x	x
22	Simoes et al. (2021)	x			x	x
23	López et al. (2020)				x	
24	Kundu & Bej (2021)	x	x		x	
25	Romero-Hall (2021)					x
26	Caligiuri et al. (2020)				x	
27	Pacheco (2020)				x	
28	Moura, Nascimento & Ferreira (2021)				x	
29	Ismailov & Ono (2021)	x	x		x	x
30	Chang & Kuo (2021)				x	x
31	Leal Filho et al. (2021)				x	x

Figure 3. Paper search records.

Table 7. Summary of six papers related to SOL (synchronous online learning) + HEI (higher education institutions) + MCO (movement control order). COVID-19 = coronavirus disease 2019.

No	Citation	Author (Year)	Paper description
1	31	Aguilera-Hermida (2020)	This paper explores college students' perception of their adoption, use and acceptance of emergency online learning, particularly their attitude, affect, motivation and perceived behavioral control and cognitive engagement using quantitative data collection methods.
2	33	Srivastava *et al.* (2021)	This paper aims to evaluate medical students' anxiety levels and its correlation with academic factors during emergency remote learning using a questionnaire survey. Research findings show that about one-fourth of medical students have anxiety issue during emergency remote learning.
3	32	Ali, Narayan & Sharma (2020)	This paper aims to provide insights on students' engagement in the learning of accounting subject during the COVID-19 disruption and the pivot to online learning based on reflections of academic staff members teaching the accounting subject at two large New Zealand universities. The findings of this paper suggests that there are some successes and challenges in engaging students in online learning of accounting subject.
4	34	Ismailov & Ono (2021)	This paper aims to examine factors that are influencing Japanese college freshmen' motivation when completing graded online assignments as part of the English reading courses during COVID-19 pandemic using qualitative method.
5	35	Tan (2020)	This paper focuses on university students by analyzing students' motivation, the community of inquiry and learning performance using quantitative analysis and paired sample t-test. Research findings indicated that due to the lack of learning infrastructures to support online learning and social support, students' motivation and learning performance are affected.
6	36	Simoes *et al.* (2021)	This paper aims to analyze biological engineering students' adaptation to virtual learning environment during COVID-19 pandemic. Research findings show that there is an overall improvement in students' performance despite changes made to pedagogical like course design, teaching method and evaluation.

Table 8. Limitations of the papers.

No	Citation	Author (Year)	Limitation
1	31	Patricia Aguilera-Hermida (2020)	No standardized questions were asked. Only students from public universities were included. Study excluded students who did not have access to the Internet.
2	33	Srivastava *et al*. (2021)	
3	37	Darling-Aduana (2021)	Components of authentic work, such as communication and interaction with peers, that were not facilitated by the online course system evaluated
4	38	Bogdan *et al*. (2021)	
5	39	Li *et al*. (2020)	
6	40	Corbin (2020)	
7	42	Tyerman, Luctkar-Flude, & Baker (2021)	
8	43	Constantin *et al* (2021)	
9	44	Philippe *et al*. (2020)	Lack of robust evaluation framework
10	45	Thomas *et al*. (2021)	
11	46	Shankar *et al*. (2021)	Investigate the impact of technology on not just retail outcomes but also on the whole retail ecosystem
12	47	Keswani, Brooks & Khoury (2020)	
13	48	Khodadad-Saryazdi (2021)	
14	49	Tessitore *et al*. (2021)	Deliberate exclusion of articles related to support from other sources
15	41	Abdelgaffar (2021)	
16	50	Applin & Flick (2021)	
17	51	Fernandez-Álvarez *et al*. (2020)	
18	52	Ironsi (2021)	Obtaining ethical consent from the participants was difficult and so the sample size was small.
19	32	Ali, Narayan & Sharma (2020)	
20	53	Badiozaman, Leong & Wong (2020)	Small sample size - Digital Educator Series training, the accuracy of the description may be unique to this particular group of individuals.
21	35	Tan (2020)	
22	36	Simoes *et al*. (2021)	
23	54	López *et al*. (2020)	
24	55	Kundu & Bej (2021)	
25	56	Romero-Hall (2021)	
26	57	Caligiuri *et al*. (2020)	
27	58	Pacheco (2020)	
28	59	Moura, Nascimento & Ferreira (2021)	
29	34	Ismailov & Ono (2021)	Study involved groups of mainly first-year Japanese students, and thus, the sample may have been rendered homogeneous.
30	60	Chang & Kuo (2021)	
31	61	Leal Filho *et al*. (2021)	

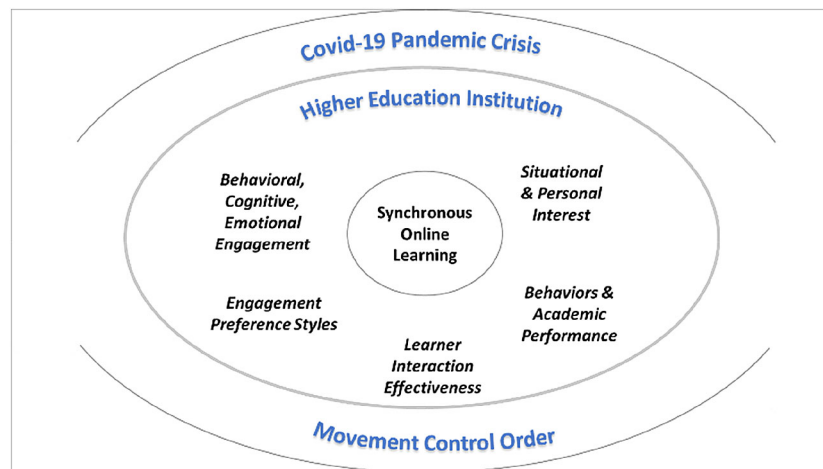**Figure 4. Conceptual framework.** COVID-19 = coronavirus disease 2019.

Table 9. Future research recommendations.

No	Future recommendations
1	Synchronous online learning (SOL) in higher education institutions (HEIs) in the movement control order (MCO) environment in terms of students' engagement preference styles.
2	Synchronous online learning (SOL) in higher education institutions (HEIs) in the movement control order (MCO) environment in terms of effectiveness of interaction between student and student, between student and instructor and student with content.
3	Synchronous online learning (SOL) in higher education institutions (HEIs) in the movement control order (MCO) environment in terms of students' behaviors and academic performance.

Future recommendations

Given the findings and discussions for this systematic literature review, Table 9 presents recommendations for future research in association with SOL in HEI under MCO.

Conclusions

This systematic literature review highlighted three research gaps associated with SOL in HEI in the MCO environment and four limitations were identified from the 31 selected research papers. A conceptual framework is proposed for future research related to synchronous online learning, engagement and interest in the movement control environment. Practical solutions can be identified to improve the effectiveness of teaching and learning in this new phenomenon.

Data availability

Underlying data

All data underlying the results are available as part of the article and no additional source data are required.

Reporting guidelines

Figshare: PRISMA flow diagram and checklist for 'Synchronous online learning during movement control order in higher education institutions: a systematic review. https://doi.org/10.6084/m9.figshare.16752031.v1.[62]

Data are available under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0).

References

1. StudyMalaysia.com: **The Malaysian Higher Education System – An Overview.** 2015, March 14.

2. Noordin N: **Higher Education in the time of the coronavirus.** *The Star Online.* 2020, April 14.

3. Bhowmick A, Khasawneh MT, Bowling SR, *et al.*: **Evaluation of alternate multimedia for web-based asynchronous learning.** *Int. J. Ind. Ergon.* 2007; **37**(7): 615–629.
   Publisher Full Text

4. Dlab MH, Boticki I, Hoic-Bozic N, *et al.*: **Exploring group interactions in synchronous mobile computer-supported learning activities.** *Comput. Educ.* 2020; **146**: 103735.
   Publisher Full Text

5. Martin F, Oyarzun B: **Distance Learning**. West RE, editors. *Foundations of Learning and Instructional Design Technology.* EdTech Books; 2018.
   Reference Source .

6. Watts L: **Synchronous and asynchronous communication in distance learning: A review of the literature.** *Quarterly Rev. Distance Educ.* 2016; **17**(1): 23.

7. Shahabadi MM, Uplane M: **Synchronous and asynchronous e-learning styles and academic performance of e-learners.** *Procedia-Social and Behavioural Sci.* 2015; **176**(20): 129–138.
   Publisher Full Text

8. Giesbers B, Rienties B, Tempelaar D, *et al.*: **A dynamic analysis of the interplay between asynchronous and synchronous communication in online learning: The impact of motivation.** *J. Comput. Assist. Learn.* 2014; **30**(1): 30–50.
   Publisher Full Text

9. Strang K: **Cooperative learning in graduate student projects: Comparing synchronous versus asynchronous collaboration.** *J. Interact. Learn. Res.* 2013; **24**(4): 447–464.

10. Stewart AR, Harlow DB, DeBacco K: **Students' experience of synchronous learning in distributed environments.** *Distance Educ.* 2011; **32**(3): 357–381.
    Publisher Full Text

11. Falloon G: **Making the connection: Moore's theory of transactional distance and its relevance to the use of a virtual classroom in postgraduate online teacher education.** *J. Res. Technol. Educ.* 2011; **43**(3): 187–209.
    Publisher Full Text

12. Khalil R, Mansour AE, Fadda WA, *et al.*: **The sudden transition to synchronized online learning during the COVID-19 pandemic in Saudi Arabia: A qualitative study exploring medical students' perspectives.** *BMC Med. Educ.* 2020; **20**(1): 285–310.
    PubMed Abstract | **Publisher Full Text** | **Free Full Text**

13. Murphy E: **Issues in the adoption of broadband-enabled learning.** *Br. J. Educ. Technol.* 2005; **36**(3): 525–536.
    Publisher Full Text

14. Hurst B, Wallace R, Nixon SB: **The impact of social interaction on student learning.** *Reading Horizons: A Journal of Literacy and Language Arts.* 2013; **52**(4): 5.

15. Moore MG: **Theory of transactional distance.** *Theoretical principles of distance education.* 1993; **1**: 22–38.

16. Trabinger KL: **Encouraging learner interaction, engagement and attention in the virtual classroom (an investigation into the phenomenon of multitasking) (Doctoral dissertation, University of Southern Queensland).** 2016.

17. Trowler V: **Student engagement literature review.** *The higher education academy.* 2010; **11**(1): 1–15.

18. Kuh GD, Kinzie J, Schuh JH, *et al.*: *Student success in college: Creating conditions that matter.* John Wiley & Sons; 2011.

19. Krause KL, Coates H: **Students' engagement in first-year university.** *Assess. Eval. High. Educ.* 2008; **33**(5): 493–505.
    Publisher Full Text

20. Bloom BS: *Taxonomy of educational objectives. Vol. 1: Cognitive domain.* New York: McKay; 1956; 20–24.

21. Renninger KA, Hidi S: *The power of interest for motivation and engagement.* Routledge; 2015.

22. Dewey J: *Interest and effort in education.* Forgotten Books; 1913.

23. Alexander PA: **Mapping the multidimensional nature of domain learning: The interplay of cognitive, motivational, and strategic forces.** *Adv. Motiv. Achiev.* 1997; **10**: 213–250.

24. Berlyne DE: **Novelty, complexity, and hedonic value.** *Percept. Psychophys.* 1970; **8**(5): 279–286.
    Publisher Full Text

25. Walkington C, Bernacki ML: **Motivating students by "personalizing" learning around individual interests:**

A consideration of theory, design, and implementation issues. *Motivational interventions.* Emerald Group Publishing Limited; 2014.

26. Hidi S, Renninger KA: **The four-phase model of interest development.** *Educ. Psychol.* 2006; **41**(2): 111–127.
    Publisher Full Text

27. Krapp A: **Interest and human development: An educational-psychological perspective.** *Development and Motivation.* 2003; **2**: 57–84.

28. Harackiewicz JM, Smith JL, Priniski SJ: **Interest matters: The importance of promoting interest in education.** *Policy insights from the behavioural and brain sciences.* 2016; **3**(2): 220–227.
    PubMed Abstract | **Publisher Full Text** | **Free Full Text**

29. Hidi S, Harackiewicz JM: **Motivating the academically unmotivated: A critical issue for the 21st century.** *Rev. Educ. Res.* 2000; **70**(2): 151–179.
    Publisher Full Text

30. Bria R, Retnowardhani A, Utama DN: **Five Stages of Database Forensic Analysis: A Systematic Literature Review.** *Proceedings of 2018 International Conference on Information Management and Technology, ICIMTech 2018, September.* 2018; 246–250.
    Publisher Full Text

31. Patricia Aguilera-Hermida A: **College students' use and acceptance of emergency online learning due to COVID-19.** *International Journal of Educational Research Open.* 2020; **1**: 100011.
    Publisher Full Text

32. Ali I, Narayan AK, Sharma U: **Adapting to COVID-19 disruptions: student engagement in online learning of accounting.** *Accounting Res. J.* 2020; **34**: 261–269.
    Publisher Full Text

33. Srivastava S, Jacob J, Charles AS, *et al.*: **Emergency remote learning in anatomy during the COVID-19 pandemic: A study evaluating academic factors contributing to anxiety among first year medical students.** *Medical Journal Armed Forces India.* 2021; **77**: S90–S98.
    PubMed Abstract | **Publisher Full Text** | **Free Full Text**

34. Ismailov M, Ono Y: **Assignment Design and its Effects on Japanese College Freshmen's Motivation in L2 Emergency Online Courses: A Qualitative Study.** *Asia-Pacific Educ. Res.* 2021; **30**(3): 263–278.
    Publisher Full Text

35. Tan C: **The impact of COVID-19 on student motivation, community of inquiry and learning performance.** *Asian Education and Development Studies.* 2020; **10**: 308–321.
    Publisher Full Text

36. Simoes C, Chatterjee P, Lemes LP, *et al.*: **Virtual learning approach to biological engineering courses in Uruguay during COVID-19.** *Higher Education, Skills and Work-Based Learning.* 2021. ahead-of-print.
    Publisher Full Text

37. Darling-Aduana J: **Authenticity, engagement, and performance in online high school courses: Insights from micro-interactional data.** *Comput. Educ.* 2021; **167**(August 2020): 104175.
    Publisher Full Text

38. Bogdan EA, Roszko AM, Beckie MA, *et al.*: **We're ready! Effectiveness of community disaster preparedness workshops across different community groups in Alberta, Canada.** *International Journal of Disaster Risk Reduction.* 2021; **55**(July 2020): 102060.
    Publisher Full Text

39. Li JPO, Liu H, Ting DS, *et al.*: **Digital technology, tele-medicine and artificial intelligence in ophthalmology: A global perspective.** *Prog. Retin. Eye Res.* 2020; 100900.

40. Corbin CB: **Conceptual physical education: A course for the future.** *J. Sport Health Sci.* 2021; **10**(3): 308–322.
    PubMed Abstract | **Publisher Full Text** | **Free Full Text**

41. Abdelgaffar HA: **A critical investigation of PRME integration practices of the third cycle champion group.** *International Journal of Management Education.* 2021; **19**(1): 100457.
    Publisher Full Text

42. Tyerman J, Luctkar-Flude M, Baker C: **Rapid Development of a COVID-19 Assessment and PPE Virtual Simulation Game.** *Clin. Simul. Nurs.* 2021; **56**: 125–132.
    PubMed Abstract | **Publisher Full Text** | **Free Full Text**

43. Constantin A, Alexandru C, Korte J, *et al.*: **Distributing participation in design: Addressing challenges of a global pandemic.** *International Journal of Child-Computer Interaction.* 2021; **28**: 100255.
    Publisher Full Text

44. Philippe S, Souchet AD, Lameras P, *et al.*: **Multimodal teaching, learning and training in virtual reality: a review and case study.**

Virtual Reality & Intelligent Hardware. 2020; **2**(5): 421–442.
Publisher Full Text

45. Thomas JG, Goldstein CM, Bond DS, *et al.*: **Evaluation of intervention components to maximize outcomes of behavioural obesity treatment delivered online: A factorial experiment following the multiphase optimization strategy framework.** *Contemp. Clin. Trials.* 2021; **100**: 106217.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

46. Shankar V, Kalyanam K, Setia P, *et al.*: **How Technology is Changing Retail.** *J. Retail.* 2021; **97**(1): 13–27.
Publisher Full Text

47. Keswani A, Brooks JP, Khoury P: **The Future of Telehealth in Allergy and Immunology Training.** *J. allergy and clin. immun.* 2020; **8**(7): 2135–2141.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

48. Khodadad-Saryazdi A: **Exploring the telemedicine implementation challenges through the process innovation approach: A case study research in the French healthcare sector.** *Technovation.* 2021; **107**(June 2020): 102273.
Publisher Full Text

49. Tessitore A, Capranica L, Pesce C, *et al.*: **Parents about parenting dual career athletes: A systematic literature review.** *Psychol. Sport Exerc.* 2021; **53**: 101833.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

50. Applin SA, Flick C: **Facebook's Project Aria indicates problems for responsible innovation when broadly deploying AR and other pervasive technology in the Commons.** *J. Respons. Tech.* 2021; **5**(December 2020): 100010.
Publisher Full Text

51. Fernandez-Álvarez J, Díaz-García A, Colombo D, *et al.*: **Digital Technologies for the Intervention of Emotion Regulation.** 2020.

52. Ironsi CS: **Google Meet as a synchronous language learning tool for emergency online distant learning during the COVID-19 pandemic: perceptions of language instructors and preservice teachers.** *J. App. Res. Higher Educ.* 2021. ahead-of-print.
Publisher Full Text

53. Adi Badiozaman IF, Leong HJ, Wong W: **Embracing educational disruption: a case study in making the shift to a remote learning environment.** *J. App. Res. Higher Educ.* 2020 December. ahead-of-print.
Publisher Full Text

54. López LLL, McCaw CT, Di Biase R, *et al.*: **The quarantine archives: educators in "social isolation".** *Hist. Educ. Rev.* 2020; **49**: 195–213.
Publisher Full Text

55. Kundu A, Bej T: **COVID 19 response: An analysis of teachers' perception on pedagogical successes and challenges of digital teaching practice during new normal.** *Educ. Inf. Technol.* 2021.
Publisher Full Text

56. Romero-Hall E: **Current initiatives, barriers, and opportunities for networked learning in Latin America.** *Educ. Technol. Res. Dev.* 2021; **69**: 2267–2283.
Publisher Full Text

57. Caligiuri P, De Cieri H, Minbaeva D, *et al.*: **International HRM insights for navigating the COVID-19 pandemic: Implications for future research and practice.** 2020.

58. Pacheco JA: **The "new normal" in education.** *Prospects.* 2020; 0123456789.
Publisher Full Text

59. Moura GG, Nascimento CRR, Ferreira JM: **COVID-19: Reflections on the Crisis, Transformation, and Interactive Processes Under Development.** *Trends in Psychology.* 2021; **29**(2): 375–394.
Publisher Full Text

60. Chang S, Kuo AC: **Indulging interactivity: a learning management system as a facilitative boundary object.** *SN Soc. Sci.* 2021; **1**(2): 1–15.
Publisher Full Text

61. Leal Filho W, Price E, Wall T, *et al.*: **COVID-19: the impact of a global crisis on sustainable development teaching.** *Environ. Dev. Sustain.* 2021; **23**: 11257–11278.
Publisher Full Text

62. Dorasamy M, Lee YW: **Prisma Flow Diagram and Checklist.** **figshare.** *Dataset.* 2021.
Publisher Full Text

F1000 **Research**

Open Peer Review

Current Peer Review Status: ✓ ✓

Version 2

Reviewer Report 07 December 2021

https://doi.org/10.5256/f1000research.79516.r100708

✓ **Jessica Sze Yin Ho** (iD)

Heriot-Watt University, Putrajaya, Malaysia

I have looked through the revision and I'm happy with the work that the authors have put in. I would like to recommend that the paper should be accepted.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Digital Marketing, higher education, sustainability

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 09 November 2021

https://doi.org/10.5256/f1000research.76986.r97281

? **Jessica Sze Yin Ho** (iD)

Heriot-Watt University, Putrajaya, Malaysia

This study is an interesting study in view of the lockdown situation. The paper is also written in a very straight-forward manner that makes it easy to follow.

Some additional comments on the paper:
1. SOL is also sometimes used in different terminologies for example hybrid-classroom. Has this been incorporated as a search term? If not, including this in the limitation of this research will be helpful for future research.

2. Similarly, MCO is a local term. It is good to see that COViD-19 has been used as a keyword. To appeal to a larger audience, other terms such as lockdown or circuit-breaker may have been studied globally. Adding more papers incorporating these search terms can help to attract a larger international audience. Justifying this will be essential for this study.

3. Generally, the findings of this paper is rather limited. The ultimate findings were based on 6 papers. Are there any other literature gaps that can be identified in this systematic literature review based in the 31 papers identified?

4. More critical discussion on the findings is expected - implication to theory and practice.

5. Conclusion - needs enhancement.

Are the rationale for, and objectives of, the Systematic Review clearly stated?
Yes

Are sufficient details of the methods and analysis provided to allow replication by others?
Partly

Is the statistical analysis and its interpretation appropriate?
Partly

Are the conclusions drawn adequately supported by the results presented in the review?
No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Digital Marketing, higher education, sustainability

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 02 November 2021

https://doi.org/10.5256/f1000research.76986.r97295

Manjula Nagarajan

Department of Management Studies, Thiagarajar School of Managemnet, Madurai, Tamil Nadu, India

The authors have done a very good work. During Pandemic (the MCO Environment) the learning process was the most hit and children were really suffering across globe. This systematic review would help authors to get into an in-depth research of SOL. Hence the area and the topic of the research is well connected with the need of the hour.

In this paper the analysis is done well and it is suggested that the authors can add on a country-wise analysis of the research papers. This could give us an idea as to which continent had contributed to this area of research more and would have paved way for increasing the scope of the research.

Are the rationale for, and objectives of, the Systematic Review clearly stated?
Yes

Are sufficient details of the methods and analysis provided to allow replication by others?
Yes

Is the statistical analysis and its interpretation appropriate?
Not applicable

Are the conclusions drawn adequately supported by the results presented in the review?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Synchronous Online learning (SOL), Impact of the learning process during the pandemic, impact of SOL on the Case teaching method a pedagogy in Management education

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

The benefits of publishing with F1000Research:

- Your article is published within days, with no editorial bias

- You can publish traditional articles, null/negative results, case reports, data notes and more

- The peer review process is transparent and collaborative

- Your article is indexed in PubMed after passing peer review

- Dedicated customer support at every stage

For pre-submission enquiries, contact research@f1000.com

F1000Research