Synchronous online learning during movement control order in higher education institutions: a systematic review

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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'
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

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Introduction

The Malaysian online learning movement started in the 1990s with the objective of providing learners access to quality education and lifelong learning opportunity. 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. 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. In SOL, students and instructors can login remotely from any location in the world and concurrently participate in the learning process. 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. These features of SOL that resemble physical learning are well accepted by students. Despite the benefits of live session, immediacy and real-time guidance and feedback, SOL has its limitations. 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.

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. 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. Behavioral, cognitive and emotional engagement are the three main engagement components. 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. Next, continuing interest requires students to endure and reengage in the learning activities over time. Therefore, educational activities that meet individual students’ needs can catch students’ attention, such as by varying the novelty, complexity and incongruity of visual stimuli. Nevertheless, the heterogeneity of individual interest and the large class size have made these tasks challenging. Hence, creating situational interest in the learning process is the first step in developing students’ individual interest 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. 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.

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.
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 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.](image)
| 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 1                   | Interest 1                     | Engagement 1                   | Engagement 1                   | Engagement 1                   | Engagement 1                   | 1 June 2021 to 15 June 2021 |
| Interest 1                     | Interest 1                     | Interest 1                     | Interest 1                     | Interest 1                     | Interest 1                     | 1 June 2021 to 15 June 2021 |
| Coronavirus disease 2019 (COVID-19) | Coronavirus disease 2019 (COVID-19) | Coronavirus disease 2019 (COVID-19) | Movement control order (MCO) | 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 |

Table 1. Search strategy.
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 with 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 papers31–36 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 papers31,32 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 131 focused only on students’ cognitive engagement, such as attitude, affect, and motivation, whereas Paper 232 focused on accounting lecturers’ reflection
Table 3. Summary of keyword search result.

| Keywords combinations | Synchronous online learning | Synchronous online learning | Synchronous online learning | Synchronous online learning | Synchronous online learning | Synchronous online learning | Date search |
|-----------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-------------|
|                       | Engagement                  | Engagement                  | Engagement                  | Engagement                  | Engagement                  | Engagement                  | 6th June 2021|
|                       | Interest                    | Interest                    | Interest                    | Interest                    | Interest                    | Interest                    | 6th June 2021|
|                       | Covid-19                    | Covid 19                   | Covid-19                    | Covid-19                    | Covid-19                    | Covid-19                    | 6th June 2021|
|                       | MCO                         | MCO                         | MCO                         | MCO                         | MCO                         | MCO                         | 6th June 2021|
|                       | HEI                         | HEI                         | HEI                         | HEI                         | HEI                         | HEI                         | 6th June 2021|

| No | Online database | Engagement | Interest | Covid-19 | MCO | HEI | Date search |
|----|----------------|------------|----------|----------|-----|-----|-------------|
| 1  | EBSCOhost      | 263        | 26       | 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           | 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           |              |
regarding students’ engagement during synchronous and asynchronous online classes. Engagement can be categorized into cognitive, behavioral and emotional engagement. 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) | | | | | | | SG, AI, AR |
| 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 | | | | | | |
| 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 | | | | | |
| 13 | 48       | Khodadad-Saryardi (2021) | Qualitative | Adoption, Routinization, Implementation | | | | | | |
| No. | Citation | Author (Year) | Theory | Method | Factor | Limitation | Has the paper discussed about these keywords? |
|-----|----------|---------------|--------|--------|--------|------------|-----------------------------------------------|
| 14  | 49       | Tessitore et al. (2021) | SOL Engagement Interest MCO HEIs | Systematic literature review | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 15  | 41       | Abdelgaffar (2021) | Qualitative | Qualitative | | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 16  | 50       | Applin & Flick (2020) | Qualitative | Qualitative | | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 17  | 51       | Fernandez-Álvarez et al. (2020) | Encyclopaedia | Qualitative | | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 18  | 52       | Ironsi (2021) | Quantitative | Qualitative | | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 19  | 32       | Ali, Narayan & Sharma (2020) | Engagement Qualitative | Engagement Qualitative | | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 20  | 53       | Badiozaman, Leong & Wong (2020) | Online teaching and learning, mastering Google Classroom, cloud-based productivity tools, netiquette, cybersecurity | Online teaching and learning, mastering Google Classroom, cloud-based productivity tools, netiquette, cybersecurity | | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 21  | 35       | Tan (2020) | Qualitative | Qualitative | | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 22  | 36       | Smae et al. (2021) | Quantitative | Quantitative | | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 23  | 54       | López et al. (2020) | Quantitative | Quantitative | | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 24  | 55       | Kundu & Bej (2021) | Quantitative | Pedagogic challenges faced | | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 25  | 56       | Romero-Hall (2020) | Quantitative | Pedagogic challenges faced | | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 26  | 57       | Calgjur et al. (2020) | Conceptual | Conceptual | | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 27  | 58       | Paciero (2020) | Quantitative | Quantitative | | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 28  | 59       | Moura, Nascimento & Ferreira (2021) | Conceptual | Conceptual | | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 29  | 54       | Ismail & Ono (2021) | Quantitative | Quantitative | | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 30  | 60       | Chang & Kuo (2021) | Cultural anxious theory | Cultural anxious theory | | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 31  | 61       | Leal Filho et al. (2021) | Quantitative | Quantitative | | Deliberate exclusion of articles related to support from other sources | Deliberate exclusion of articles related to support from other sources |
| 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                           | x                              |
| 2  | Srivastava et al. (2021)          | x                                | x          | 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                           | 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                           | 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)           |                                  |            |          |                             |                                |
| 27 | Pacheco (2020)                    |                                  |            |          |                             | x                              |
| 28 | Moura, Nascimento & Ferreira (2021) |                                  |            |          |                             |                                |
| 29 | Ismailov & Ono (2021)             | x                                | x          |          |                             | x                              |
| 30 | Chang & Kuo (2021)                |                                  | x          |          |                             | x                              |
| 31 | Leal Filho et al. (2021)          |                                  |            |          |                             | 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 issues 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 suggest 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. |
| 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       | Constantine 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       | Simões 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) | |
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).

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Version 2

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Jessica Sze Yin Ho
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

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Jessica Sze Yin Ho
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.
Manjula Nagarajan
Department of Management Studies, Thiagarajar School of Management, 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.
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