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The Effectiveness of Tele-education for Health Field University Students as a Learning Method during a COVID-19 Pandemic: A Systematic Review

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Abstract

BACKGROUND: The COVID-19 pandemic has been affecting many aspects including education globally as many countries closed the school temporally.

AIM: This study aimed to summarize the effectiveness of tele-education application among health field university students.

METHODS: PubMed and EBSCO databases for studies published up to August 2020 were searched. Studies reporting the academic performance or skills performance or students satisfaction were included in the study. Study quality was assessed using the Joanna Briggs Institute appraisal tool.

RESULTS: Published between 2002 and 2020, 22 studies were conducted in developed countries and two studies in developing countries. The tele-education method included e-learning, virtual, and digital learning. When comparing to control group, of 15 studies intervention studies measuring academic performance, seven studies showed a higher mean score among intervention group. For skills performance, there were no studies showing higher skill performance. For studies measuring student' satisfaction, one-third showing higher student' satisfaction among the intervention group compared to the control.

CONCLUSION: Our finding highlighted the positive effect of various tele-education on academic performance among the health field university students. Applying the various tele-education in the learning process for the health field university students during the COVID-19 pandemic is suggested.

Introduction

The COVID-19 pandemic has been affecting many aspects including education. It may due to the global policy among many countries to close the school temporally to prevent the spreading of the disease [1], [2]. On the severe acute respiratory syndrome epidemic that had been occurred in 2003, a study stated that many students had been halted due to the outbreak [3]. Therefore, an alternative learning method to overcome the situation is urgently needed.

Tele-education as the application of technology in the delivery of distance learning has been used for decades to facilitate students who lived in remote areas to learn [4]. The main component including audio, video, and computer [4]. However, the effectiveness of this method was unclear. A study in Palestine stated the application of tele-education among medical and nursing students worked at the Gaza territory was effective in achieving the learning outcome [5]. Campbell *et al*. found that the use of tele-education in diagnosing ophthalmic disease was also effective, however, there was a limitation in controlling the precision of the diagnosis [6].

The variability of conclusive information on the application of tele-education requires additional study. The study aimed to conduct a systematic review to summarize the effectiveness of tele-education applications among medical field university students.

Materials and Methods

Search strategy

Using PRISMA guidelines for a systematic review, databases were searched up to August 2020 included PubMed and EBSCO [7]. The terms used in the searches varied according to the database utilized, thus included tele-education, nursing, physician, pharmacy, student, medical, effectiveness, academic performance, student's satisfaction, pandemic, and outbreak.

A study was eligible for inclusion if it included adult health science students reported academic performance and/or student' satisfaction.

Experimental/clinical trials, cohort, and cross sectional with or without a control group were included in the study. Studies were excluded if they were not in English. Two researchers (LR and IP) independently screened all titles, abstracts, and full texts and appraised study quality. The disagreement was resolved by a third researcher (RD).

Data extraction

Data extraction included author, year of publication, study location, study design, population, sample size, and demography, intervention type, assessment tools, and measured outcome.

Quality assessment

Study quality was assessed using the Joanna Briggs Institute critical appraisal checklist tool for randomized control trials (RCTs) studies, non-randomized, and cohort studies [8]. All tools for each study have four categories of the answer: Yes, no, unclear, and not applicable. The tool for RCT, non-randomized, and cohort studies consists of 13, nine, and 12 items, respectively.

Results

Two databases provided 869 articles from the year 1989 to August 2020 (Figure 1). After excluding duplicates, and applying inclusion and exclusion criteria, 126 articles remained. After full-text examination, 26 articles remained for quality appraisal. Most studies met the criteria for the appraisal (Table 1).

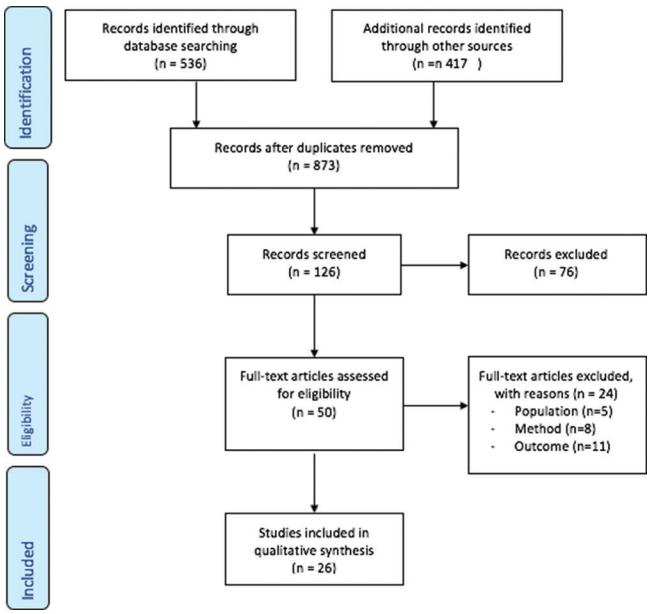

Figure 1: Flow diagram describing article selection

Study characteristic

Published between 2002 and 2020, 22 studies were conducted in developed countries and two studies in developing countries (Table 1). Published between 2002 and 2020, 22 studies were conducted in developed countries and two studies in developing countries (Table 1), eleven in the United States, two in Egypt, two in Germany, and one each in the United Kingdom, Singapore, Sweden, Norway, Canada, Taiwan, Italy, Spain, Brazil, Iran, and Croatia. RCT design was used by seven studies [9], [10], [11], [12], [13], [14], [15], while 15 studies used quasi-experimental design [16], [17], [18], [19], [20], [21], [22], [23], [24], [25], [26], [27], [28], [29], [30]. Cohort design was used by four studies [31], [32], [33], [34]. The sample size ranged from 9 in Reese' experimental study [28] in the USA to 2700 in Aboshady *et al*. study in Egypt [31] (Table 1). In most studies, the majority of subjects were women. Subject age, provided by 10 studies, ranged from 18.3 (16) to 33.0 (24) years.

Academic performance

The use of various tele-education showed a various effect on academic performance (Table 2). When comparing to the control group, several studies showed a various mean score of the test in the experimental group including higher, lower, and no significant different. Among seven intervention e-learning studies, four studies showed higher mean score [9], [13], [15], [29], while, one study showed a lower score [16] and two studies showing no significant difference [10], [23]. For virtual learning studies, among five intervention studies, two studies showed higher mean score [17], [25], one study with a lower score [26], and two studies with no significant difference [11], [18]. For digital learning studies, among three intervention studies, only one study showed a higher mean score [22], while, two studies with no significant difference [14], [24].

Skills performance

The effect of tele-education on skills performance was also documented in several studies (Table 3). When comparing to the control group, among the two intervention e-learning studies, there were no studies showed higher skills performance in the experimental group. One study showed a lower degree of skill performance [16] and one study with no significant difference [10]. For intervention virtual learning studies, there was one study that showed a comparison with no significant difference [18]. For intervention digital learning studies, there was no study provided the comparison.

Student satisfaction

The effect of tele-education on student satisfaction was also documented in several studies

Table 1: Characteristic of studies

Authors	Country	Study design	Study fields of participants	Sample size (n)	Exposure (n)	Control (n)	Female (%)	Period	Age (years)
Abdelaziz *et al*. (2011) [16]	Egypt	Quasi-experimental	Nursing	276	90	186	63.3	Non-pandemic	18.3
Aboshady *et al*. (2015) [31]	Egypt	Cohort	Medical	2700					
Attardi *et al*. (2018) [17]	Canada	Quasi-experimental	Medical	491	138	353	51.9	Non-pandemic	20.9
Back *et al*. (2014) [32]	Germany	Cohort	Medical	147	147				
Bello *et al*. (2005) [18]	Italy	Quasi-experimental	Medical	56	28	28	60.7	Non-pandemic	28.5+1.6
Bhatti *et al*. (2011) [9]	USA	RCT	Medical	148	75	73	53.3	Non-pandemic	22 (21-27)
Boye *et al*. (2012) [19]	Norway	Quasi- experimental	Medical	84	84			Non-pandemic	
Chi and Chang (2002) [20]	Taiwan	Quasi- experimental	Medical	154	106	48			
Cubo *et al*. (2017) [21]	Spain	Quasi- experimental	Medical	120	120		66.7	Non-pandemic	
Dolan *et al*. (2015) [10]	UK	RCT	Health science	22	12	10		Non-pandemic	
Gossenheimer *et al*. (2017) [22]	Brazil	Quasi-experimental	Nursing	74	74		89.3	Non-pandemic	23.9 (19.0-31.0)
Graber (2019) [23]	USA	Quasi-experimental	Nursing	110	63	47		Non-pandemic	
Hubble and Richards (2006) [24]	USA	Quasi-experimental	Paramedic	31	21	10		Non-pandemic	33 (7.1)
Authors	Country	Study design	Population	Sample size (n)	Exposure (n)	Control (n)	Female (%)	Period	Age (years)
Kidd and Stamatakis (2006) [25]	USA	Quasi-experimental	Pharmacy	113	75	38		Non-pandemic	25.6 (3.0)
Klibanov *et al*. (2018) [26]	USA	Quasi-experimental	Pharmacy	108	16	92	67.0	Non-pandemic	28.0 (5.0)
Kukolja-Taradi *et al*. (2008) [27]	Croatia	Quasi-experimental	Medical	68	68			Non-pandemic	
Libby *et al*. (2017) [33]	USA	Cohort	Dentistry	122	122		95.6	Non-pandemic	
Mattheos *et al*. (2003) [11]	Sweden	RCT	Dentistry	39	24	15		Non-pandemic	
Phadtare *et al*. (2009) [12]	USA & Brazil	RCT	Medical	48	24	24	54.2	Non-pandemic	23.5 (1.5)
Raupach *et al*. (2009) [13]	Germany	RCT	Medical	148	74	74		Non-pandemic	
Reese *et al*. (2009) [28]	USA	Quasi-experimental	Psychology	9	9			Non-pandemic	
Sichani *et al*. (2018) [29]	Iran	Quasi-experimental	Medical	47	47		40.5	Non-pandemic	22.5 (0.6)
Solomon *et al*. (2004) [14]	USA	RCT	Medical	29	17	12		Non-pandemic	
Srinivasan (2020) [34]	Singapore	Cohort	Medical	16	16			COVID-19 pandemic	
Subramanian *et al*. (2012) [15]	USA	RCT	Medical	30	15	15		Non-pandemic	
Vogt *et al*. (2010) [30]	USA	Quasi-experimental	Nursing	52	52			Non-pandemic	

RCT: Randomized control trial.

(Table 2). When comparing to the control group, among the two intervention e-learning studies, one study showed a higher satisfaction level [12], while one study showed no significant different [23]. For intervention virtual learning studies, one study showed a higher satisfaction level [18], while one study showed no significant difference [28]. For intervention digital learning study, only one study provided the comparison that showed a lower degree of satisfaction in the experimental group [20].

Discussion

The effectiveness of tele-education on academic performance, skills performance, and satisfaction among health field university students has been documented. Our summary highlights the effect on academic performance as the majority of the included studies showed a positive effect. Nearly half of intervention studies measuring the effect on academic performance showed the increasing mean score. An earlier systematic review study by Chipps *et al*. [35] found a similar finding, however, the review only focused on virtual learning, while our study included virtual, e-learning, and digital learning. Furthermore, the previous study only found one study supported the positive effect, while our review found seven studies.

The improvement of skills performance on students also has been documented in one-third of studies provided data related. The previous review found a greater percentage of studies showing the improvement of skill performance [36]. The few studies

Table 2: Academic performance, skill performance, and students' satisfaction across the studies (n = 26)

Authors	Academic performance	Skill performance	Satisfaction
Abdelaziz *et al*. (2011) [16]	OG versus CG: 25.8 ± 8.4 versus 29.2 ± 65.6)	OG versus CG: 95.6 versus 96.8	
Aboshady *et al*. (2015) [31]			84% of students satisfied
Attardi *et al*. (2018) [17]	OG versus CG: 78.33 ± 18.81 versus 77.04 ± 8.00		
Back *et al*. (2014) [32]	OG versus CG: 73.20 versus 44.00		
Bello *et al*. (2005) [18]	no different	No different	OG versus CG: 10.0 versus 9.0
Bhatti *et al*. (2011) [9]	OG versus CG's increase score: 3.66 versus 3.23		
Boye *et al*. (2012) [19]			88% of students satisfied
Chi and Chang (2002) [20]			Online was less satisfied than face to face
Cubo *et al*. (2017) [21]			Students satisfaction: 51.6%
Dolan *et al*. (2015) [10]	No different	No different	
Gossenheimer *et al*. (2017) [22]	OG versus CG: 7.7 versus 7.2		
Graber (2019) [23]	No different		No different
Hubble and Richards (2006) [24]	No different		
Kidd and Stamatakis (2006) [25]	OG versus CG: 3.41 versus 3.25		
Klibanov *et al*. (2018) [26]	Distance versus control: 81.5 ± 9.5 versus 86.9 ± 7.1		
Kukolja-Taradi *et al*. (2008) [27]	97% of students passed examination		Most students were satisfied
Libby *et al*. (2017) [33]			No different
Mattheos *et al*. (2003) [11]	No different		
Phadtare *et al*. (2009) [12]			Online versus control: 4.3 ± 0.73 versus 3.09 ± 1.11
Raupach *et al*. (2009) [13]	OG versus CG: 2.5 ± 1.1 versus 2.0 ± 1.2		
Reese *et al*. (2009) [28]			No different
Sichani *et al*. (2018) [29]	OG versus CG: 19.67 ± 4.63 versus 17.42 ± 4.08)		
Solomon *et al*. (2004) [14]	No different		
Srinivasan (2020) [34]			87.5% of students satisfied
Subramanian *et al*. (2012) [15]	OG versus CG: 86.7 ± 2.0 versus 61.7 ± 2.0		
Vogt *et al*. (2010) [30]	No different		60% of students were satisfied

OG: Online group; CG: Control group.

reporting an improvement among the experimental group in our finding may due to the study design used. Most studies used e-learning which may give less effect on skill performance compare to virtual or digital learning. Furthermore, the potential reason may due to the less effect of tele-education on the skills aspect of the students.

Our study also revealed a high number of studies showing a higher satisfaction level among tele-education students group compared to the traditional lecture. This finding was higher than earlier systematic review reporting only one-sixth of studies with higher satisfaction [36].

The important finding in our study was the positive effect of various type of tele-education on academic performance as shown by the majority of the included studies. The finding shown by each type of tele-education may provide the benefit of using tele-education in several methods among health field university students, particularly during the COVID-19 pandemic. The selection of methods is important in a pandemic situation as many students may be halted due to national protocol. Providing several effective types of tele-education may prevent further disturbance in the learning process.

The limitation found in our study included the lack of studies conducted during the COVID-19 period. It may due to the disturbance of data collection during that time as many countries worldwide applied lockdown during the crisis. However, we believe the various trials with various types of tele-education may overcome the limitation found. Further study in comparing the effectiveness of tele-education during the pandemic era and non-pandemic era may be needed.

Conclusion

Our finding highlighted the positive effect of various tele-education on academic performance among the health field university students. Applying the various tele-education in the learning process for health field university students during the COVID-19 pandemic is suggested.

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