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

Laili Rahayuwati*, Iqbal Pramukti*, Raini Diah Susanti

Department of Community Health Nursing, Faculty of Nursing, Universitas Padjadjaran, Sumedang, West Java, Indonesia

Abstract

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

![Flow diagram describing article selection](https://oamjms.eu/index.php/mjms/index)

**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 |
| Aboushady et al. (2015) [31] | Egypt | Cohort | Medical | 2700 | | | | | |
| Attard 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. (2000) [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 | | | | |
| Chi and Cheng (2002) [20] | Taiwan | Quasi-experimental | Nursing | 154 | 106 | 48 | | | |
| Cubo et al. (2017) [21] | Spain | Quasi-experimental | Medical | 120 | 120 | | | | |
| Dolan et al. (2015) [17] | UK | RCT | Health science | 22 | 12 | 10 | | | |
| 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 | | | |
| Hubble and Richards (2006) [24] | USA | Quasi-experimental | Paramedic | 31 | 21 | 10 | | | Non-pandemic | 33 (7.1) |

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 ± 96.8 | | 84% of students satisfied |
| Aboushady et al. (2015) [31] | OG versus CG: 78.33 ± 8.18 versus 77.04 ± 8.00 | OG versus CG: 73.20 ± 44.00 | | |
| Attard et al. (2018) [17] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Back et al. (2014) [32] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Bello et al. (2000) [18] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Bhatti et al. (2011) [9] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Boye et al. (2012) [19] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Chi and Cheng (2002) [20] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Cubo et al. (2017) [21] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Dolan et al. (2015) [17] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Gossenheimer et al. (2017) [22] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Graber (2019) [23] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Hubble and Richards (2006) [24] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Kidd and Stamatikas (2006) [25] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Klibanov et al. (2004) [27] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Libby et al. (2017) [33] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Phadtare et al. (2003) [12] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Raupach et al. (2009) [13] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Reiss et al. (2009) [29] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Siddique et al. (2018) [28] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Solomon et al. (2004) [14] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Sinha et al. (2015) [31] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Subramanian et al. (2012) [15] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |
| Vogt et al. (2010) [30] | OG versus CG: 73.20 ± 44.00 | OG versus CG: 73.20 ± 44.00 | No different | OG versus CG: 10.0 versus 9.0 |

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.

Discussion

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
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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