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Investigations On The Effectiveness Of Online Teaching In English And Assessment In Clinical Laboratory Sciences During Covid-19 Pandemic

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Abstract

As of November 2019, the worldwide COVID-19 outbreak has impacted every aspect of life, particularly educational programs at various institutions. Online ones across the world replaced on-campus educational

activities. Consequently, starting in March 2020, all educational activities in Saudi Arabia were being conducted online. As lockdown due to COVID-19 in Saudi Arabia ended in August 2020, alternative teaching and assessment plan implanted from March to June 2020 was changed to on-campus laboratory sessions and exams while still maintaining online teaching for theory courses during the fall semester of the academic year 2020-21 (CLAB-CTP 6.1). The assessment plan was modified accordingly (CLAB-CTP 6.2). Detailed safety guidelines for students, faculty, and staff were developed under the directions of the ministry of education and ministry of health to avoid COVID-19 exposure (CLAB-CTP 6.3). It included proper schedules to allow only a small number of students at a time on-campus (10-12 students), thermal screening at college entry points, social distancing, mandatory use of masks, frequent sanitization of workplaces before and after use, etc. These measures are considerably helping in avoiding student, faculty, and staff exposure COVID-19 in the program, college, and the university. A survey was used for the effectiveness of online teaching and assessment plans to achieve student learning outcomes and student satisfaction about virtual teaching. Student course evaluation surveys showed that student satisfaction about delivery of the courses during the COVID-19 pandemic was not significantly different from previous academic years (Figures 1b-6b). Surveys specifically targeted about virtual teaching show students' satisfaction about various aspects of online teaching. To improve any deficiency in student psychomotor skills due to COVID-19 lockdown, risk assessment subcommittee organized a meeting to set up an action plan for further improvement in student psychomotor skills (CLAB-CTP3.1). Under COVID-19 lockdown, contingency teaching and assessment plans were effective with student learning outcomes in all learning domains. Students were overall satisfied with online teaching and assessment.

INTRODUCTION

COVID-19 pandemic has affected every sector of life, including teaching and learning activities at different institutes throughout the world, since November 2019. Maqsood, Abbas, Rehman, and Mubeen (2021) have analyzed that this pandemic situation put instructors and students under a lot of stress and created a lot of confusion for these online learners. COVID-19 was a hypothetical situation. However, in Saudi Arabia, student access to a technological base was made possible thanks to assistance from academics and staff. Due to that, routine on-campus teaching activities have been changed to online teaching throughout the world. Due to that, all teaching and learning activities in Saudi Arabia have switched to online education since March 2020. The Information Technology Department preferred Blackboard Ultra for online teaching for six Clinical Laboratory Sciences Programs at the College of Applied Medical Sciences, King Saud Bin Abdul Aziz University for Health Sciences, Alhasa campus.

LITERATURE REVIEW

Implementation of Online teaching and learning

The year 2020 has had a significant impact on how many industries in the globe operate. No industry will remain the same as it was before 2020. Learning is no exception. The epidemic has impacted all

educational levels, particularly university education (Almetwazi, Alzoman, Al-Massarani, & Alshamsan, 2020). Universities in Saudi Arabia have faced unusual and unforeseen circumstances, requiring them to go internet and switch to Emergency Remote Education (Al Lily, Ismail, Abunasser, & Alqahtani, 2020). Saudi Arabia's colleges and universities had no exceptions. On March 8, 2020, Saudi Arabia closed down all schools, colleges, and universities (Almaghaslah & Alsayari, 2020). As a result, the Ministry of Education has been ordered to promptly switch to synchronous and asynchronous virtual classrooms. Thankfully, virtually all Saudi Arabian public colleges have had ICT infrastructure since the century began, however, usage varies (Albugami & Ahmed, 2015). Upon looking at the internet sites of all 25 Saudi Arabian universities, it was discovered that each one has an organizational unit, primarily the deanship, that specializes in online teaching and Virtual Classrooms (17 universities) or oversees the use of e-learning systems and technology that makes (Walabe, 2020).

All these institutions used Blackboard as their central learning management system. As a result, several Saudi institutions have switched to alternative platforms, mostly video-conferencing systems, such as Microsoft Teams. Saudi Arabia's King Saud Bin Abdul Aziz University is one of the state universities that has embraced another program, Microsoft Teams MT), adding to Blackboard.

Al Zahrani et al. (2021) have informed that the ministry of education, Saudi Arabia, urgently allowed online teaching permission for lab programs soon after the COVID-19 pandemic. Clinical Laboratory Sciences Program (CLAB) at College of Applied Medical Sciences (CoAMS), King Saud Bin Abdulaziz University of Health Sciences (KSAU-HS) started changes on-campus teaching to online teaching from March 15, 2020, per directions of the ministry of education after implementation of lockdown throughout the kingdom of Saudi Arabia. A learning management system with capabilities of online teaching and assessment (Blackboard, Blackboard Inc.) was already being utilized by all programs across KSAU-HS, including CLAB, since 2009. It has a specific feature called "Blackboard Ultra" for online education. "Blackboard Ultra" for online teaching was used in Saudi Universities (Hakim, 2020; Iffat Rahmatullah, 2021; Khan, 2020). All faculty members and students were provided links and online videos for training in "Blackboard Ultra." Khan (2020) finds that the Saudi government has allowed Microsoft Teams for a learning management system in Saudi universities. As a substitute, Microsoft Teams was also included in the learning management system at KSAU-HS. All CLAB faculty members carried out online teaching using a learning management system through MS PowerPoint lectures, online videos (youtube, etc.), and virtual laboratory experiment resources like HHMI bio interactive, labster, etc. Table 1 demonstrates the list of courses taught and assessed online during the COVID -19 pandemic. Alqurshi (2020) finds Microsoft Teams (MT) as an extraordinary effort to train all on the basic use of software such as creating virtual classrooms and

online exams on Blackboard and Microsoft teams to which the faculty members were able to use efficiently in a short time, as many were split between learning how to operate new technologies and teaching. Thus. Table 1 shows the courses conducted online during the Covid-19 pandemic.

Table 1: List of the courses conducted online during the COVID-19 pandemic (March-Jun 2020)

Course Code	Course name	Block
CLAB 416	**Microbiology Clinical Education (3rd year, Block 5)**	3rd year, Block 5
CLAB 316	**Parasitology**	3rd year, Block 5
CLAB 320	**Molecular Diagnostics**	4th Year, Block 9
CLAB 321	**Molecular Diagnostics Laboratory**	4th Year, Block 9
CLAB 417	**Blood Bank/Immunohematology Clinical Education**	4th Year, Block 9
CLAB 418	**Laboratory Medicine Case Studies Seminar**	4th Year, Block 9

Phase 2 of alternative teaching and learning (Sep-Dec 2020)

As lockdown due to COVID-19 in Saudi Arabia ended in August 2020, alternative teaching and assessment plan implanted from March to June 2020 was changed to on-campus laboratory sessions (Ali et al., 2021). Exams were maintained online teaching for theory courses during the fall semester of the academic year 2020-21 (CLAB-CTP 6.1). The assessment plan was modified accordingly (CLAB-CTP 6.2). Detailed safety guidelines for students, faculty, and staff were developed under the directions of the ministry of education and the ministry of health to avoid COVID-19 exposure (Al Zahrani et al., 2021). Similarly, detailed safety guidelines for students, faculty, and staff were implemented at KSAU-HS. (CLAB-CTP 6.3). It included proper schedules to allow only a small number of students at a time on-campus (10-12 students), thermal screening at college entry points, social distancing, mandatory use of masks, frequent sanitization of workplaces before and after use, etc. These measures are considerably helping in avoiding student' faculty and staff exposure COVID-19 in the program, college, and the university (Tripathi et al., 2020).

RESEARCH QUESTIONS

The study had the following research questions:

1. What is the effectiveness of online teaching during the Covid-19 pandemic on Clab students learning outcomes and student satisfaction about virtual teaching?

2. What is the effectiveness of teaching in a pre-Covid-19 pandemic period on Clab students learning outcomes?

RESULTS

1. Implementation of an online assessment plan:

A contingency assessment plan was devised and implemented in compliance with the university directions and ministry of education guidelines. The same assessment plan was implemented among the program in the three campuses (CLAB-CTP2.1). The contingency assessment plan was targeted to assess student achievement and see the effectiveness of online teaching and learning under the COVID-19 pandemic.

2. Effectiveness of online teaching and assessment plan:

Achievement of student learning outcomes (percent achievement) and student satisfaction (score out of 5) about the courses conducted during COVID-19 lockdown (March-Jun 2020) were compared to calculate the effectiveness of online teaching and assessment plan to see any significant changes in student learning outcome achievement and their satisfaction.

3. Achievement of student learning outcomes and student satisfaction about virtual teaching:

The college faculty were able to achieve all course learning outcomes in all domains of learning without any significant differences compared to previous years (Figures 1a-6a) where the overall score was 4.07 and 3.87, which is a satisfactory score regarding the achievement of student learning outcomes and student satisfaction about virtual teaching.

4. Action plan for improvement in student psychomotor skills:

To improve any deficiency in student psychomotor skills due to COVID-19 lockdown, the risk assessment subcommittee organized a meeting to set up action plan for further improvement in student psychomotor skills (CLAB-CTP3.1). It was planned that communication will be made with internship training sites, and arrangements will be made with them to provide internees with more hands-on training related to laboratory courses conducted during the COVID-19 pandemic. Appropriate arrangements are underway in this regard (CLAB-CTP3.2).

According to the results Figures, 1a provides the results where the college faculty concerning their hardworking students during virtual teaching were able to accomplish all course learning outcomes in all learning domains with a value of 4.07 and 3.87, respectively, which is a decent score for student learning outcomes and they were satisfied with digital education.

Figure 1a: CLAB 320 Course (Molecular Diagnostics): Comparison of achievement of course learning outcomes in different domains of learning during COVID19 pandemic (AY 2019-20) with a pre-COVID19 session (AY-2018-9)

Figure 6a demonstrates that the answers to the questions asked during the survey reached the maximum. The overall score was from 3.46 to 3.92. These questions were asked about the course, instructors, and resources. Figure 6a: shows the CLAB 321 Course (Molecular Diagnostics Laboratory): which is about a comparison of achievement of course learning outcomes in different domains of learning during the COVID19 pandemic (AY 2019-20) with a pre-COVID19 session (AY-2018-9)

Figure 6a: CLAB 321 Course (Molecular Diagnostics Laboratory): Comparison of achievement of course learning outcomes in different domains of learning during COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-9)

Similarly, student course evaluation surveys showed that student satisfaction about the delivery of the courses during the COVID-19 pandemic was not significantly different from previous academic years (Figures 1b-6b). Surveys specifically targeted virtual teaching show students' satisfaction with various aspects of online teaching (Figure 7). Figure ab and figures 6b show the CLAB 320 Course (Molecular Diagnostics), which is a comparison of student satisfaction during the COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-9). Course learning outcomes and learning domain 80.50% to 100% where percentage achievement was 120% maximum. All this reveals that students were delighted that the courses' delivery during the pandemic was significant.

Figure 1b: CLAB 320 Course (Molecular Diagnostics): Comparison of student satisfaction during COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-9)

Students' satisfaction with various components of online education has been demonstrated in surveys tailored particularly to virtual teaching (Figure 7). An assessment of overall satisfaction during the COVID19 epidemic and the pre-COVID19 period is shown in figure ab and figure 6b of the CLAB 320 Course (Molecular Diagnostics) (AY-2018-9). According to course assessment questionnaires, figure 6b presents students' contentment with course delivery during the COVID-19 epidemic was not distinct from conventional academic years (Figures 1b-6b). There was the highest percent accomplishment of 120 percent for course learning outcomes and the learning domain. Student satisfaction with course delivery was excellent during the epidemic, according to this data.

Figure 6b: CLAB 321 Course (Molecular Diagnostics Laboratory): Comparison of student satisfaction during COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-9)

Surveys specifically designed for virtual teaching have shown that users are satisfied with various aspects of online education which here Figure 7 reveal exactly. Even during the COVID19 pandemic and the period before the COVID19 outbreak, an analysis of overall satisfaction can be seen in figures ab and 6b of the CLAB 320 Course (AY-2018-9). Figure 7 provides the results in accordance with course evaluation questionnaires; students' satisfaction with course delivery did not differ during the COVID-19 pandemic from that of normal academic years, as earlier shown in Figure 6b and Figures 1b-6b. Course learning outcomes and the learning domain had the most incredible percent completion rate at 120 percent. According to these findings, students were quite happy with the way their courses were delivered during the pandemic, as shown in Figure 7.

Figure 7: CLAB students' satisfaction about virtual teaching and its benchmarking with BS Nursing program

Figure 21 below illustrates some of the main attributes of the CLAB 316 Course (Parasitology). A Comparison of achievement of course learning outcomes in different learning domains during the COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-9) presents higher scores ranging from 75.75 to 93.56. The students who were studying this course of parasitology set out for a very positive response.

Figure 2a: CLAB 316 Course (Parasitology): Comparison of achievement of course learning outcomes in different domains of learning during COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-9)

On the other side, in Figure 2b, there is a clear trend of increasing overall course evaluation survey scores up to 3.80 for the CLAB 316 Course (Parasitology). This Comparison of student satisfaction during the COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-9) shows the students' satisfaction.

Figure 2b: CLAB 316 Course (Parasitology): Comparison of student satisfaction during COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-9)

What is interesting about the survey data is that Figure 3a as given below, is about CLAB 416 Course, which is a Microbiology Clinical Education course. This figure provides a comparison of achievement of course learning outcomes in different domains of learning during the COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-9). What is striking about the figure down is the maximum score of 94% out of 100%, which shows the highest achievement of course learning outcomes in different domains of learning during the COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-9).

Figure 3a: CLAB 416 Course (Microbiology Clinical Education): Comparison of achievement of course learning outcomes in different domains of learning during COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-9)

Figure 3b is quite revealing in several ways. First, unlike the other figures, different scores relate to courses, instructor, resources, and an overall score. Figure 3b is about CLAB 416 Course, which is about the Microbiology Clinical Education course. This figure reveals a comparison of student satisfaction during the COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-9). The scores of 4.04 and 3.86 indicate that the students were very happy when this course was being taught during the pre-pandemic.

Figure 3b: CLAB 416 Course (Microbiology Clinical Education): Comparison of student satisfaction during COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-9)

The data in Figure 4a shows that the length of time left between during and pre-pandemic sessions provides an excellent comparison of course learning outcomes in different learning domains. The minimum is 69.6, whereas the maximum score is 100. Overall, the survey results show that CLAB 417 Course about Blood Bank Immunology /Clinical Education was a source of reasonable satisfaction by the students.

Figure 4a: CLAB 417 Course (Blood Bank Immunology /Clinical Education): Comparison of achievement of course learning outcomes in different domains of learning during COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-9)

Data from this Figure 4b below can be compared with the data in Figure 4a, which shows almost a different result because here, the overall score from courses, instructors, and resources is 3.84 from all the sides. The survey result data regarding CLAB 417 Course (Blood Bank Immunology /Clinical Education) shows the most exciting comparison of positive student satisfaction during the COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-9).

Figure 4b: CLAB 417 Course (Blood Bank Immunology /Clinical Education): Comparison of student satisfaction during COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-9)

As Figure 5a shows, there is no significant difference between the two groups when comparing course learning outcomes in different domains of learning during the COVID19 pandemic (AY 2019-20, blue) with the pre-COVID19 session (AY-2018-9, red). Thus, pre and during pandemic survey results were very friendly and almost equal, as shown in the bars of the figures for the CLAB 418 Course (Laboratory Medicine Case Studies Seminar).

Figure 5a: CLAB 418 Course (Laboratory Medicine Case Studies Seminar): Comparison of achievement of course learning outcomes in different domains of learning during COVID19 pandemic (AY 2019-20, blue) with the pre-COVID19 session (AY-2018-9, red)

The results, as shown in Figure 5b, indicate that CLAB 418 Course (Laboratory Medicine Case Studies Seminar) showed a slight difference of 3.8 to 3.9 during comparison of student satisfaction during the COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-9). However, the overall score for the course, instructors, and resources was satisfactory in both the academic sessions.

Figure 5b: CLAB 418 Course (Laboratory Medicine Case Studies Seminar): Comparison of student satisfaction during COVID19 pandemic (AY 2019-20) with the pre-COVID19 session (AY-2018-19)

DISCUSSION

Very little was found in the literature on the question of contingency teaching and assessment education plans by the Clinical Laboratory Sciences Program during the COVID-19 pandemic in Saudi Arabia. The studies were conducted in confined to an institution for a new coronavirus associated with human respiratory disease in China having knowledge, attitude, and practices toward COVID-19 in a Saudi Arabian population and no study for during and pre-pandemic era (Adam et al., 2021). The present study was the only study that studied many Clab programmed together: Microbiology Clinical Education, Parasitology, Molecular Diagnostics, Molecular Diagnostics Laboratory, Blood Bank/Immunohematology Clinical Education, and Laboratory Medicine Case Studies Seminar. There is no such study that conducted all these courses together during and pre-pandemic period. However, some studies have a lab program for only during covid 19 effects. Hoq (2020) has found that as Covid 19 breaks out, online research starts with the literacy levels and education of the population rise among Laboratory Sciences students. Still, this study also misses the opportunity to discuss the pre-pandemic period and missed the relationship of both the tenures.

The study was planned on the opinion of e-learning in education during the pandemic period, but its focus was on the teachers' perceptions and not on the students' views. The survey results showed that most of them had very positive opinions about online teaching during pandemic virus for college laboratories in Saudi Arabia. In another research, AlJishi et al. (2021) was conducted in the same eastern region of Saudi Arabia at King Saud Bin Abdul Aziz University for Health Sciences. This observational research had the clinical presentation, radiographic, and laboratory data of COVID-19 patients are described. Results showed that the researchers found a total of 82 adult COVID-19 patients between March 1 and April 5, 2020. This research where the patients at the National Guard Hospital were the target population differs from the current research where students' learning domains were the targets for the comparisons. Moreover, the present research study is a survey research which is quite different from an observational research study. As the Clinical Lab area was different so the conclusion revealed that the number of patients in the inaugural COVID-19 Epicenter in this eastern region which is called Alhasa in the Kingdom of Saudi Arabia were asymptomatic and return tourists. Nearly 50 % of the patients had comorbid conditions. In the year 2020. Thus, no such research conducted on the Clab up till now for the student population for during and pre pandemic outbreak. However, the survey was successful as it was able to identify students learning outcomes.

In the current study, in accordance with university rules and ministry of education requirements, a contingency assessment plan was designed and deployed. A uniform evaluation framework was used across all three locations (CLAB-CTP2.1). An evaluation strategy for the event of the COVID-19 outbreak was put in place to examine how well online tutoring worked. All these arrangements make this unique study research, as further elaborated below:

1. Teaching and evaluation plans that use the internet are more efficient.

The percentage of the respondents who met or exceeded their learning objectives (percent accomplishment) and the percentage of students who were satisfied (score out of 5) for the courses taken during the COVID-19 clampdown from March to June 2020 were matched to measure the efficiency of the online teaching and assessment plan.

2. Student learning results and contentment with virtual teaching are both achieved:

According to the results, teachers accomplished all course training objectives in all learning domains with a score of 4.07 and 3.87, respectively, which is a good score in terms of student achievement and students' satisfaction with digital instruction.

3. Plan of action to develop the psychomotor abilities of students:

The risk evaluation subcommittee convened a meeting to draw up an action plan for future positive effects on student psychomotor skills in correcting any deficiencies owing to COVID-19 lockout in student psychomotor abilities (CLAB-CTP3.1). During the COVID-19 virus, a connection and agreement will be established with suitable training locations to give interns additional hands-on training relevant to laboratory courses. In this regard, appropriate measures are being made (CLAB-CTP3.2).

RECOMMENDATIONS

This is an important issue for future research. Still, the question does arise that there is ample room for further progress in determining students learning outcomes with and without a pandemic period. Therefore, a different study focusing on students learning styles is suggested to emphasize lab research in the future (Alsofayan, Althunayyan, Khan, Hakawi, & Assiri, 2020). Similarly, Khalil et al. (2020) suggested further research for dry labs in Saudi Arabia due to their study in Qassim University, Bureda. Future aspirations were unambiguous in the study where the online modality was quite well, with all participants agreeing that online sessions saved time and that they respond better because of the increased functionality of time; nevertheless, they stated that they encountered some difficulties during trainings and online exams, including methodological, content perception, technical, and behavior problems. Most preclinical students preferred online education for the future academic years. The notion of synchronized virtual classrooms appealed to medical graduates. This has a significant and beneficial effect on future medical education in the lab science field. This study also recommended that the concepts of the online learning system and learning results should be thoroughly and frequently examined to determine its usefulness for future situations.

Moreover, the current study had a particular limitation because it was only conducted in a teaching institution of the eastern region in Alhasa city of the Kingdom of Saudi Arabia with the student population. This study did not have a mixed-method and used surveys for result analysis. In the future, more studies can be conducted on the same issues with more effective methods such as mixed methods or more groups in experimental studies with observations.

CONCLUSION

Under COVID-19 lockdown, contingency teaching and assessment plans were effective in achieving student learning outcomes in all learning domains. Students were overall satisfied with online teaching and assessment. Considering the limitations of virtual education in laboratory sessions, an action plan was devised to provide students extra practical training during the internship.

Furthermore, phase-2 of online curriculum delivery includes on-campus delivery of laboratory courses and exams with proper safety measures to avoid exposure to COVID-19.

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