E-learning Readiness among Dental Students and Faculty Members Pre-COVID-19 Pandemic

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Abstract

Purpose: The purpose was to assess students’ and faculty readiness toward online dental education in Saudi Arabia. Materials and Methods: This is a cross-sectional study using a 5-point Likert scale questionnaire distributed to students (undergraduates and postgraduates) and faculty at King Abdulaziz University, Faculty of Dentistry, Jeddah, Saudi Arabia, in 2018. It assessed individual characteristics, system competency needs, social influence, institutional support, overall readiness, and the needed technical support in using e-learning for personal as well as teaching and learning (T&L) purposes. The readiness response scale for each domain was categorized as follows: low (mean value = 1–<3), acceptable/moderate (mean value = 3–<4), and high readiness level (mean value = 4–5). Descriptive and group comparisons were conducted using Pearson’s Chi-square test, paired sample t-test, independent sample t-test, one-way ANOVA, and Tukey’s post hoc test. The statistical significance level was set at P < 0.05. Results: The total completed response rate was 400/550 (72.7%) comprising undergraduates (n = 312), postgraduates (n = 38), and faculty (n = 50). The results showed an acceptable level of online skills with no statistically significant difference between the groups (P > 0.05). A statistically significant difference between the two categories of uses, personal and T&L, was found (P < 0.05). The undergraduate students reported statistically significantly lower readiness level in online English literacy, perceived impact of online technology on education, technology accessibility, importance of institutional support, overall readiness, and the need for technical support (P < 0.05). Conclusion: Significant differences between students’ and faculty readiness for e-learning adoption in dental education were reported. The current study captured the pre-pandemic e-readiness of students and faculty as a baseline for future assessment of pandemic effect on education.

Keywords: Curriculum reform, dental education, e-learning, online, technology

INTRODUCTION

Educational institutes are facing many challenges to survive under the dilemma of the current global economic pressures and the pressing demands on higher education institutions to provide quality instruction for the current “Net” students without underpinning the educational strategies. The COVID-19 pandemic has challenged medical and dental education even further and made online teaching and learning (T&L) a mandated fact and not just a vision. Saudi Arabia was one of the first countries that shifted to remote teaching during the current pandemic. Digital transformation was already on the country’s agenda. The National e-Learning Center was established as an independent entity by the Councils of Ministers of Saudi Arabia. The scope of this center is to enhance and support trust in the e-learning programs, lead innovation in learning and digital transformation, and enable the integration among educational institutions and labor market needs. Despite these efforts, faculty resistance and the associated steep learning curve persisted. Universities worldwide are also foreseeing e-learning, or online learning, approaches as a valuable solution in leading and controlling education in the current crisis.

E-learning is T&L with the use of technology. This combination has made e-learning a challenging approach to education. Technology is a rapidly changing asset. It requires much...
skills and competencies from the users. More importantly, technology is urging the educational institutes to re-consider their agility to change in order to cope with the rapidly changing technological advances. Technology-based education, or e-learning, is also changing the face of education and learning architecture. The expanded possibilities supported by technology have called for new concepts and skills in T&L, as well as, in knowledge and information transfer. Technology, with its no limitations of users, has further opened a channel for connected information as well as networked learners between the educational and workforce sectors. This by virtue mandated both sectors to work at the same pace and goal to build a stable and sustainable environment for human beings. Under such pressures, institutes and decision makers need to work hardly and sharply in drawing a clear vision and strategic planning in implementing e-learning approaches in the educational as well as the workforce fields to meet the demands of the global changes. The health profession educational fields are part of the broad education architecture. In fact, it is one of the most highly demanding fields for change to cope with the needs of the current and future human needs. The health profession educational fields, including dental education, are reforming their curriculum and re-designing their educational strategies to meet the demands of the 21st century. Within this process, e-learning is no longer considered an optional approach to serve the future educational needs. It is, in fact, considered the infrastructure for the future learning architecture.

Saudi Arabia is currently working for clear visions and strategic planning concerning resources, organization management, and technology infrastructure to assure sustainability and pace in the implementation and management of e-learning systems. The Faculty of Dentistry, at King Abdulaziz University, is one of the biggest colleges in Saudi Arabia that is serving the country educationally as well as for health services. The Faculty of Dentistry, at King Abdulaziz University, is adopting e-learning programs to meet the quality standards of T&L. The purpose of this research is to investigate the skills, perceptions, needs, and readiness of the undergraduates, postgraduates, as well as faculty members at the Faculty of Dentistry, King Abdulaziz University, toward the use of such technology for T&L. Supporting the current curricular changes and reform in the college, the findings of this study can help curriculum as well as organizational managers in planning a meaningful strategy that puts e-learning technology at its most appropriate and sustainable position in the college. The current study also captures the pre-pandemic e-readiness of students and faculty that helps in drawing a baseline for the current institutional agility to change, and thus help policymakers in setting their goals and strategic planning toward the needs and speed for coping with the global changes.

**Materials and Methods**

**Research design**

This is a cross-sectional survey conducted in 2018 in the Faculty of Dentistry (KAUFD), King Abdulaziz University, Jeddah, Saudi Arabia. The objective of the survey was to investigate the readiness of the undergraduate and postgraduate students as well as faculty members in adopting e-learning approaches in T&L, with special emphasis on online tools and skills. Based on multiple theories in the adaptation of technology, this research followed the general scheme of the model proposed, assessed, and validated by Al-Harbi. A similar model was also validated by Cidral et al. The model included constructs and relationships of factors that have an influence on e-learning readiness. Those constructs were grouped into the following four domains: individual characteristics, system competency needs, social influence, and institutional support. The model had also been used by Linjawi and Alfadda in 2018 to assess a cohort group of students for e-learning readiness. The model was explained in detail with all its components in their study.

**Sample**

All undergraduate dental students from 2nd to 6th year, and a random sample of the postgraduate students and faculty from different dental specialties attending at KAUFD at the time of the study, were selected as the sample of the study.

**Questionnaire design**

Based on the proposed model and after thorough literature review, a detailed questionnaire was designed to assess the e-learning readiness among dental students and faculty members at KAUFD. The questionnaire consisted of 41 questions as follows: 34 questions using (5-point Likert scale), 5 questions using multiple-choice format, and 2 questions in an open-ended format. The questionnaire was designed for assessing six main domains, each with multiple subdomains as follows:

1. **Individual characteristics domain**: including the following subdomains:
   a. Demographic data: Including age, gender, and the teaching experience (for faculty only)
   b. E-learning experience: this subdomain was designed to assess the experience of the participants in e-learning activities
   c. Computer skills: For assessing the participants’ computer skills.

2. **System competency needs domain**:  
   a. Perceived ease of use: to assess the participants’ perception at two different categories of uses, for personal uses as well as for T&L uses. The subdomain included the following variables:
      i. Online skills in using different online services and tools  
      ii. Motivation level in using online tools in T&L
      iii. English literacy in online communication.
   b. Perceived usefulness: 
      i. Importance of online technology for the success of the participants in both categories of uses: personal as well as T&L uses  
      ii. Impact of e-learning on education.
   c. Technology accessibility

3. **Social influence domain or social norms**: For assessing the influence of the surroundings on using online services.
This variable was also assessed at both categories of uses: personal as well as T&L uses

4. Institutional support domain includes technical and administrative institutional support for adopting e-learning in T&L

5. Overall readiness domain

6. Needed technical support domain: for assessing the participants’ need of technical support for adopting e-learning strategies in dental education.

The two open-ended questions were designed to assess the concerns and challenges that face the participants in adopting e-learning in T&L with the suggested recommendations.

**Methods of assessments**

A total of 550 questionnaires were randomly distributed as follows: 400 questionnaires for the undergraduate, 50 for the postgraduates, and 100 for the faculty, which were randomly distributed to the intended target sample during the year 2018. The responses were then collected, and data were analyzed.

The study was approved by the Research Ethics Committee of KAUFD. The investigators provided no guidance while the participants were reporting their answers. Written informed consent was provided by each respondent, and the study was performed in agreement with the Declaration of Helsinki.

When there were more than two missing responses in one question, the questionnaire was excluded. Responses were grouped according to participant’s position into three groups as follows: undergraduate, postgraduate, and faculty.

**Statistical analysis**

The means and standard deviations were calculated, and the overall readiness level was analyzed. The overall readiness level was further grouped according to the mean readiness value into:

- Low readiness level: for means between (1) and (<3)
- Acceptable readiness level: for mean values between (3) and (<4)
- High readiness level: for mean values between (4) and (5).

Independent sample $t$-test, paired sample $t$-test, Chi-square test, one-way ANOVA, and Tukey’s *post hoc* test were further calculated for the differences in responses between the groups. In an attempt to assess the research model, correlations and linear regressions were conducted to explore the predictor variables for the “overall readiness to e-learning implementation.” The obtained data were tabulated in Excel, and statistical analysis at $P < 0.05$ was performed using IBM SPSS statistics for Windows, version 22.0 (IBM Corp., Armonk, NY, USA).

**Results**

The total response rate was 78% ($n = 429/550$). However, due to missing major data in some questionnaires, 29 questionnaires were excluded as follows; 23 from the undergraduate collected questionnaires, 2 from the postgraduates, and 4 from the faculty. Accordingly, 400 responses were included and recorded from the following study groups; undergraduates ($n = 312$ responses), postgraduate ($n = 38$ responses), and faculty ($n = 50$ responses).

**Individual characteristics domain**

The mean age distribution was; 21 years old (range 17–25 years) for the undergraduate, 26 years old (range 28–40 years) for the postgraduates, and 37 years old (range 25–65 years) for faculty group. The teaching experience among the participated faculty members varied with 42% of them had 5 years or less of teaching experience. The number of participated females were slightly higher than males with no significant gender difference between the three groups (male = 170, 42.5%; female = 230, 57.5%; $P > 0.05$). The number of participants with previous e-learning experience ($n = 284, 71\%$) were significantly higher than those with no experience ($n = 116, 29\%$) ($P < 0.05$) [Table 1].

Results showed a high level of readiness in computer skills (Mean score = 4.09 ± 0.66) among all participants. No significant difference between the three studied groups was reported ($P > 0.05$) [Table 1].

**System competency needs domain**

**Perceived ease of use**

**Online skills**

A high level of online skills among all participants was reported for online skills for personal uses showing no significant difference between the groups ($P > 0.05$). While for T&L, the online skills were at an acceptable level and were not statistically significantly different between the groups ($P > 0.05$). However, a statistically significant difference was found in online skills between personal and T&L purposes ($P < 0.001$) [Table 2].

**Motivation level**

An acceptable motivation level in both categories of uses was reported for all groups. The results indicated that the undergraduates reported statistically significantly lower mean score in motivational level when using online tools for personal uses compared to the faculty group ($P < 0.05$) and statistically significantly lower mean score in motivational level for using online tools in T&L compared to the other two groups ($P < 0.001$). The results further showed that the motivation level between the two categories of uses, personal and T&L uses, was statistically significantly different ($P < 0.05$) [Table 2].

**English literacy in online communication**

A high readiness level for English literacy in online communication was reported for all groups in all purposes of use except for the undergraduates it was acceptable for T&L purpose. The results indicated that online English literacy was not statistically significantly different between the two categories of uses ($P > 0.05$). The results also indicated that the undergraduates reported statistically significantly lower online English literacy readiness level than the faculty in both categories of uses: personal ($P < 0.01$) and T&L ($P < 0.05$) [Table 2].
Perceived usefulness
Importance of online technology to participants' success
A high readiness level among all participants was reported for their perceived importance of online technology for their successes in education with no statistically significant difference between the two categories of uses ($P > 0.05$). The results also indicated that the perceived importance was not statistically significantly different between the three studied groups in the two categories of uses ($P > 0.05$) [Table 2].

Impact of e-learning on education
An acceptable readiness level among all participants was reported for their perceived impact of e-learning on education. The results indicated that the undergraduates reported significantly lower score in their perception than the other two groups ($P < 0.01$) [Table 2].

Technology accessibility
A high readiness level among all participants was reported for technology accessibility. The results showed that the undergraduates reported statistically significantly lower score in technology accessibility than the faculty group ($P < 0.01$) [Table 2].

Social influence domain
An acceptable level of social influence was reported in both categories of uses, personal and T&L purposes, with no statistically significant difference in social impact between them ($P > 0.05$). The results also indicated no statistically significant difference in the social influence between the three studied groups in the two categories of uses ($P > 0.05$) [Table 2].

Institution support domain
A high importance level of institutional technical and administrative support in online technology was reported with no statistically significant difference between the two categories of uses ($P > 0.05$). The results further indicated that the undergraduates and postgraduates reported a statistically significantly lower score than the faculty in the level of importance of institutional support for using online technology for personal uses ($P < 0.01$). The undergraduates also reported a statistically significantly lower score than the faculty in the importance level of institutional support for T&L uses ($P < 0.05$) [Table 2].

Overall readiness domain
An acceptable level of readiness for e-learning implementation in education was reported. The undergraduates reported a statistically significantly lower readiness level than the postgraduates and faculty groups ($P < 0.001$) [Table 2].

Needed technical support domain
More than 40% of the undergraduates reported a need of support as follows: advanced computer skills, using the web...
### Table 2: Mean and standard deviations for the domains assessed among the three study groups

| Domain                        | Undergraduate students | Postgraduate students (n = 38) | Faculty (n = 50) | Between two categories of uses |
|-------------------------------|------------------------|-------------------------------|-----------------|-------------------------------|
|                              | Personal uses          | T&L uses                      | Personal uses   | T&L uses                      | Personal uses | T&L uses |          |                      |
| System influence              |                        |                               |                 |                               |               |         |          |                      |
| Perceived ease of use         |                        |                               |                 |                               |               |         |          |                      |
| Online skills                 | 4.02 (0.77)            | 3.69 (0.84)                   | 3.82 (1.00)     | 3.58 (1.11)                   | 3.97 (0.83)   | 3.56 (1.13) | 0.000*** |
| Motivation level in using online tools | 3.50** (0.76)         | 3.301*** (0.70)              | 3.72** (0.83)   | 3.622*** (0.82)              | 3.825* (0.72) | 3.662*** (0.83) | 0.049*   |
| English literacy in online communication | 4.02** (1.09)         | 3.881* (1.18)                 | 4.39** (1.00)   | 4.241,2* (1.17)              | 4.56b** (1.05) | 4.342* (1.26) | 0.146    |
| Perceived usefulness          |                        |                               |                 |                               |               |         |          |                      |
| Perceived importance of online technology | 4.25 (0.98)          | 4.19 (1.05)                   | 4.37 (1.03)     | 4.42 (1.06)                   | 4.56 (0.64)   | 4.52 (0.79) | 0.206    |
| Perceived impact of e-learning on education | 3.79*** (1.24)       |                               | 4.34b** (0.58)  |                               | 4.26b** (0.57) |           |
| Technology accessibility      | 4.03*** (0.70)         |                               | 4.06*** (0.61)  |                               | 4.36b* (0.55) |           |
| Social influence              |                        |                               |                 |                               |               |         |          |                      |
| Impact of social influence on online technology uses | 3.88 (0.92)          | 3.84 (0.94)                   | 4.01 (1.18)     | 3.91 (1.23)                   | 3.99 (0.98)   | 3.95 (0.96) |           |
| Institutional support         |                        |                               |                 |                               |               |         |          |                      |
| Importance of technical and administrative support on online technology uses | 4.09*** (0.97)       | 4.061* (1.01)                 | 4.11*** (1.20)  | 4.131,2* (1.26)              | 4.56b** (0.81) | 4.522* (0.89) | 0.374    |
| Overall readiness level       |                        |                               |                 |                               |               |         |          |                      |
| Overall readiness             | 3.11*** (1.39)         |                               | 4.00b*** (0.87) |                               | 3.90b*** (0.84) |           |

Significant level set at \((P<0.05)\). Estimates with different symbols \((*P<0.05, **P<0.01, and ***P<0.001)\) are significantly different between the personal and T&L purposes of use for each category, estimates with different symbols \((a, b, and c)\) are significantly different between groups for the personal purposes of use \((by Tukey’s post hoc criteria)\), estimates with different symbols \((1, 2, and 3)\) are significantly different between groups for the T&L purposes of use \((by Tukey’s post hoc criteria)\). T&L: Teaching and learning.
and online tools in education, designing online contents, and time management. The postgraduates reported the needs of support as follows; using the web and online tools in education and designing online contents only. While more than 40% of the faculty reported the training needs as follows: managing multimedia content, using the web and online tools in education, and designing online contents. The results showed a statistically significant difference between the groups in the different technical support needed (P < 0.05) [Figure 1].

**Pearson’s correlation and linear regression based on “Overall Readiness to E-learning Implementation”**

Linear regression analysis, based on “overall readiness to e-learning implementation,” indicated that 45.6% of the overall readiness level was affected by the variables used in the current research model. Thus, domains in the study model can be considered to have a significant moderate effect in assessing the readiness level of the agility of the participants to adopt and implement e-learning in education (F (12, 387) = 27.08, R² = 0.456, P < 0.0001) [Table 3].

**DISCUSSION**

Most participants in this study showed a high level of online skills, especially when using online tools for personal uses. However, faculty members showed better motivational level for using online tools for T&L than students. One of the important factors to consider when interpreting such findings is the reported low English literacy readiness level among the undergraduate students. Technology accessibility is the second important factor to consider which was reported to be insufficient for the undergraduate students.

E-learning mandates new T&L strategies. It also requires high level of technology, communication, collaboration, as well as time and networking management skills. Social media and mobile technology are pushing the boundaries of education even further, thus requiring much planning and support from teachers and decision makers. With the current era’s changes and demands, faculty and postgraduate students in the current study foresee the significance and importance of e-learning implementation in dental education. Such direction seems to be challenging to the current dental educational environment. To overcome such barriers, the current study strongly highlighted the importance of a top-down action with proper institutional and administrative support. Faculty and students’ training and support are also important to achieve a well-aligned e-learning implementation program. This is in agreement with many previous studies.

The current study focused on assessing the teachers and learners’ readiness to e-learning adoption at KAUFD. The findings will aid in evaluating the agility of the educational institutes to cope with the changing demands in education. In-depth analysis into users’ readiness and agility to adopt e-learning technologies with more attention to the functionality of the technology and the contextual factors that might impact the continuance and sustainability of those systems is limited in the dental literature. A comprehensive review conducted by Nortvig and implement e-learning in education (F (12, 387) = 27.08, R² = 0.456, P < 0.0001) [Table 3].

**Figure 1:** Percentages of responses toward the different technical support needs assessed among the three study groups. Statistical significance level set at P < 0.05

| Table 3: Results of Pearson’s correlation coefficient and linear regression analysis based on “Overall readiness to e-learning implementation in education” |
|---|---|---|---|---|---|
| **Predictors** | **Pearson correlation** | **P** | **β** | **SE** | **β coefficient** |
| Constant | -1.242 | 0.494 |
| Gender | -0.005 | 0.461 | 0.126 | 0.108 | 0.047 |
| Position | 0.239 | 0.000*** | 0.184 | 0.077 | 0.095 |
| E-learning experience | 0.156 | 0.001** | 0.073 | 0.114 | 0.025 |
| Computer skills | 0.269 | 0.000*** | 0.009 | 0.095 | 0.004 |
| Online skills in T&L uses | 0.171 | 0.000*** | 0.008 | 0.068 | 0.005 |
| Motivational level in T&L uses | 0.239 | 0.000*** | 0.280 | 0.084 | 0.155 |
| Online English literacy in T&L uses | 0.202 | 0.000*** | 0.025 | 0.122 | 0.009 |
| Perceived importance of online technology to participants’ success | 0.263 | 0.000*** | 0.026 | 0.064 | 0.020 |
| Perceived impact of e-learning on education | 0.627 | 0.000*** | 0.684 | 0.049 | 0.588 |
| Technology accessibility | 0.191 | 0.000*** | -0.041 | 0.089 | -0.021 |
| Social influence | 0.199 | 0.000*** | -0.048 | 0.063 | -0.035 |
| Institutional support | 0.281 | 0.000*** | 0.121 | 0.062 | 0.094 |

Number of participants = 400. Significant using Pearson’s correlation test at *P<0.05, **P<0.01, and ***P<0.001 level. Linear regression results: F (12, 387) = 27.08, R² = 0.456, P<0.0001. T&L: Teaching and learning, SE: Standard error
et al., in 2018, investigated the factors affecting students’ satisfaction and learning outcomes with e-learning and blended learning.[2] Similar to the current findings, they found that system, social, administrative, and technological supports are important factors influencing e-learning adoption.[2, 9] E-learning has the potential to shift the learning paradigm from the classic passive teacher-centered model to active learner-centered learning and, hence, provide an environment that promotes deeper learning.[10] This, in turn, supports the pedagogical principles required to insure the competency-based dental curriculum.[15, 16] Most of the studies on e-learning in dental education have focused on students’ experience with many reported positive remarks.[1, 3, 8, 17] However, some challenges were also reported from instructors, students, administrators, and developers in adopting e-learning strategies, especially in the health professions.[3, 9, 17] Although information and communication technology skills and confidence appeared to be improved among educators, the confidence in controlling teaching and learner support through the technology is still not to its sustainable and continueable level, especially in the health professional fields.[2, 8, 9, 17]

E-learning as well as virtual T&L became a fact with the COVID-19 pandemic issue. The current study was conducted in 2018, however, its findings are important for policymakers to understand the agility of the users in order to plan for the coming challenges. Further studies are needed in different parts of the country, especially after the experience with the current COVID-19 educational crisis management using online education to strategically and economically lead the coming educational era especially in the health professional fields.

**Conclusion**

- The results showed acceptable level of online skills among the three studied groups with no statistically significant difference between them ($P > 0.05$)
- A statistically significant difference was found in almost all skills assessed between the two categories of uses, personal and T&L ($P < 0.05$)
- The undergraduate students’ readiness level was statistically significantly lower in online English literacy, perceived impact of online technology on education, technology accessibility, importance of institutional support, overall readiness, and the need for technical support ($P < 0.05$).

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**Conflicts of interest**

There are no conflicts of interest.

**References**

1. George PP, Papachristou N, Belisario JM, Wang W, Wark PA, Cotic Z, et al. Online eLearning for undergraduates in health professions: A systematic review of the impact on knowledge, skills, attitudes and satisfaction. J Glob Health 2014;4(1):010406.
2. Nortvig A, Petersen A, Balle SH. A literature of the factors influencing e-learning and blended learning in relation to learning outcome, student satisfaction and engagement. Electron J E Learn 2018;16:46-55.
3. Rasmussen K, Belisario JM, Wark PA, Molina JA, Loong SL, Cotic Z, et al. Offline e-learning for undergraduates in health professions: A systematic review of the impact on knowledge, skills, attitudes and satisfaction. J Glob Health 2014;4:010405.
4. Sam AH. Digital clinical placement for medical students in response to COVID-19. Acad Med 2020;10.1097.
5. Al-Harbi KA. e-Learning in the Saudi tertiary education: Potential and challenges. Applied Comput Inf 2011;9:31-46.
6. Aljabre A. An exploration of distance learning in Saudi Arabian Universities: Current practices and future possibilities. Int J Bus Hum Technol 2012;2:132-7.
7. Al-Shehri AM. E-learning in Saudi Arabia: ‘To E or not to E, that is the question’. J Family Community Med 2010;17:147-50.
8. Cidral WA, Oliveira T, Di Felice M, Aparicio M. E-learning success determinants: Brazilian empirical study. Comput Educ 2018;122:273-90.
9. Al-Samarraei H, Teng BK, Alzahrani AI, Alalwan N. E-learning continuance satisfaction in higher education: A unified perspective from instructors and students. Stud Higher Educ 2018;43:2003-19.
10. Vaona A, Banzi R, Kgweg KH, Rigon G, Cereda D, Pecoraro V, et al. E-learning for health professionals. Cochrane Database Syst Rev 2018;1:CD011736.
11. Al-Asnani AM, Rabb Khan MS. E-learning in Saudi Arabia: Past, present and future. Near Middle Eastern J Res Educ 2014;2014:2.
12. Linjawi AI, Alfadda L.S. Students’ perception, attitudes, and readiness toward online learning in dental education in Saudi Arabia: A cohort study. Adv Med Educ Pract 2018;9:855-63.
13. Khatoon B, Hill KB, Walmsley AD. Can we learn, teach and practise dentistry anywhere, anytime? Br Dent J 2013;215:345-7.
14. McAndrew M, Johnston AE. The role of social media in dental education. J Dent Educ 2012;76:1474-81.
15. Bouhnik D, Carmi G. E-learning environments in academy: Technology, pedagogy and thinking dispositions. J Inf Technol Educ Res 2012;11:201-19.
16. Creasy JA, Whipp PR, Jackson B. Teachers’ pedagogical content knowledge and students’ learning outcomes in ball game instruction. ICHPERSD J Res 2012;7:3-11.
17. Neville V, Lam M, Gordon CJ. The impact of eLearning on health professional educators’ attitudes to information and communication technology. J Multidiscip Healthc 2015;8:75-81.