Original Research Article   **Orthodontics**

Learning Platforms Adopted during the COVID-19 Pandemic: Acceptability, Challenges and Coping Strategies of the Southern Nigerian Dental Students

Sylvia Simon Etim[1*], Abiodun Olabisi Arigbede[2]

[1]Department of Orthodontics and Paediatric Dentistry, Faculty of Dentistry, College of Health Sciences, University of Port Harcourt, Port Harcourt- Rivers State, Nigeria
[2]Department of Conservative Dentistry and Prosthodontics, Faculty of Dentistry, College of Medicine, University of Port Harcourt, Port Harcourt- Rivers State. Nigeria

*Corresponding author: Sylvia Simon Etim
Department of Orthodontics and Paediatric Dentistry, Faculty of Dentistry, College of Health Sciences, University of Port Harcourt, Port Harcourt- Rivers State, Nigeria

Abstract

The COVID-19 pandemic opened the way for innovative medical education since the face-to-face teaching method for orthodontics before the pandemic was impracticable. This study assessed the acceptability of the learning strategies adopted for teaching orthodontics in the Southern Nigerian Dental schools during the COVID-19 pandemic by the students, the associated challenges faced by them, and their coping strategies. This was a descriptive cross-sectional study conducted among Southern Nigerian dental students using a semi-structured Google form questionnaire. Information on socio-demographic data, learning platforms adopted for teaching Orthodontics during the COVID-19 pandemic, acceptability of these platforms, possible challenges faced by the students, and their coping strategies were collected. Data was inputted and analyzed using descriptive statistics (mean and frequency) and inferential statistics (Z-test). The test of significance was set at $P< 0.05$. There were 118 participants, 64 (54.2%) males and 54 (45.8%) females with a mean age of 25.738+/-2.94 yrs. The platforms adopted mostly include Zoom, WhatsApp, and Google Meet. Seventy-two (61.0%) respondents accepted the teaching platforms adopted during the pandemic and the challenges faced by the respondents were mainly lack of hands-on clinical sessions and network problems. Forty-seven (40%) of the participants coped by using self-directed learning, 20 (17.2%) used YouTube videos. Most of the students accepted the innovative teaching platforms adopted for teaching Orthodontics during the COVID-19 pandemic. Lack of hands-on clinical sessions was the major challenge faced by the students then and they coped well by using self-directed learning and YouTube videos.
Keywords: Online learning, COVID-19 pandemic, Orthodontics, self-directed learning, YouTube-Video, Coping Strategies.

INTRODUCTION

Medical education has always been carried out largely through face-to-face and hands-on clinical teaching methods over the years. These entail physical contact between the teacher and students. The physical lectures were however, disrupted during the COVID-19 pandemic following the closure of schools by the Federal Government of Nigeria. Orthodontics education has a great need for clinical activities which the pandemic surely disrupted as it requires close contact with patients and trainers. E-learning teaching platforms like Zoom, Google Classroom, Google Meet, WhatsApp, Skype, and several Learning Management Systems had to be adopted for teaching and learning during that time. Teachers could use those platforms to interact with their students and make their lectures interesting and engaging. The adoption of e-learning was not limited to Nigeria alone at that time, it was a universally adopted mode of study during the pandemic. In Egypt for example, many dental schools made use of the hybrid learning model, and this means lectures were introduced via e-learning platforms, while face-to-face learning was restricted to laboratory and clinical courses that cannot be delivered from a distance because of the psychomotor skills requirements (Mohamed *et al*., 2021). In the United States of America, most dental schools put their clinical activities on hold except for dental emergencies

while most of the didactic lectures in dental schools were remotely delivered (Iyer, 2020). In Brazil, teaching platforms like Google educational tools, Skype, Facebook, Instagram, YouTube, WhatsApp, Telegram, LinkedIn, Pinterest, zoom, Jitsi, Microsoft Teams, and Webex were used for learning during the COVID-19 pandemic (Machado *et al.*, 2020). Students enrolled in massive open online courses in Saudi Arabia and were extremely excited to study using various creative instructional tools such as video and interactive animations (Alzahrani *et al.*, 2020). The educational sector in Pakistan switched to the use of manikins, virtual reality, and haptic technologies which are said to be particularly effective for dentistry education (Haroon *et al.*, 2020). The story was not different in India, as they also had online dental education during the COVID-19 pandemic (Shrivastava *et al.*, 2022). In China, Hung *et al.*, (2021) advocated the use of online lectures, case studies, and problem-based learning tutorials for dentistry education during the epidemic. Distance education was used in Italy as revealed in a research by Bennardo *et al.*, (2020) stating that online examinations . Free educational software such as G Suite for education and Microsoft Office 365 education was recommended, which could be used by universities with not so many resources. Because of the drawback of virtual and haptic technology, simple, easily managed, affordable, light and compact mannikins, were recommended for students in France during the COVID-19 pandemic (Galibourg, 2020). Online lessons, with/and portable equipment, also allow students to practice and collaborate in real time with lecturers.

The COVID-19 pandemic opened the way for innovative medical education in order for learning to continue in the Universities. However, the learning challenges faced by the Southern Nigerian dental students with the adopted learning platforms during the last COVID-19 pandemic were not clear, the coping strategies of the students were yet to be investigated and it has not been ascertained whether the learning strategies adopted by their teachers for teaching Orthodontics at that time were acceptable. This information is important for developing improved learning interaction in the future. This study will help orthodontics educators to have an open mind on various ways Orthodontics can be taught especially technologically driven ways of knowledge delivery. In Nigeria, most accredited dental schools are located in the Southern- region. The aim of this study therefore was to find out: whether the adopted teaching platforms for teaching Orthodontics during the COVID-19 pandemic were acceptable to the Southern Nigerian dental students, the challenges faced by the students with the adopted learning platforms and the coping strategies employed by them.

MATERIALS AND METHOD
This descriptive cross-sectional study was conducted among Southern Nigerian dental students using a semi-structured Google form questionnaire. Eight accredited government owned Universities in the Southern region of Nigeria were involved in the study and these include the University of Ibadan, University of Lagos, Obafemi Awolowo University, Ile-Ife, University of Port Harcourt, University of Benin, University of Calabar, University of Nigeria, Nsukka and Lagos State University. There were a total of one hundred and fifty-eight clinical dental students in these schools, being taught Orthodontics during the COVID-19 pandemic out of which only one hundred and eighteen participated in the study. The questionnaire used for this study had 3 sections. Section A elicited information on socio-demographic data, Section B elicited information on the learning strategies adopted for teaching Orthodontics during the COVID-19 pandemic and the acceptability of these learning platforms while Section C involved open-ended questions to elicit information on possible learning challenges faced by the students at that time and their coping strategies. The questionnaire was adapted from that used in a previous publication by Cheng *et al.,* (2021) and modified to suit the learning environment in which this survey was conducted. In each of the involved Dental schools, a contact person was appointed to assist in reaching out to the targeted participants. Duly filled Google forms were sent directly to the researcher's mailbox for analysis. Three reminders were sent at a week interval to those who failed to submit the completed Google forms three days after sending the Google form to their WhatsApp and email addresses. Those who failed to return a properly filled questionnaire and those who did not give their consent were excluded from the study. Data was inputted and analyzed using Descriptive statistics (mean and frequency) and inferential statistics (Z-test) were performed using SPSS version 26. Thematic analysis used for the open-ended questions. The test of significance was set at $P< 0.05$.

Ethical clearance for the study was duly obtained from the Ethics and Research Committee of the University of Port Harcourt with reference number UPH/CEREMAD/REC/MM87/100.

RESULTS
There were 118 respondents, 64 (54.2%) males and 54 (45.8%) females, giving a ratio of 0.5 to 0.4 with a mean age of 25.74 +/- 2.94 years.

Table 1 shows that the teaching and learning platforms adopted were, Google Classroom, WhatsApp, Zoom, Google Meet, and physical Learning platforms. Precisely, during the COVID-19 pandemic, fifty-one (43.4%) of the participants said they used WhatsApp to learn Orthodontics, this was followed by those who signified that they used Zoom, 26(22.0%). Those who signified that they used Google Classroom were seven (5.5%). Five (4.1%) of the participants signified that they had Orthodontic lectures each using Google Meet and physical lectures.

Table 1: Number count and percentage showing the teaching platforms adopted in teaching Orthodontics during the COVID-19 pandemic in Southern Nigerian dental schools

Teaching Platforms Adopted	Number Count	Percentage %
Google Classroom (Online Platform)	7	5.5%.
WhatsApp	51	43.4%
Zoom	26	22.0%
Google Meet	5	4.1.%
Other Online platform	1	1.4%
Physical lectures	5	4.1%
None	23	19.3%

Table 2 shows that the participants who accepted the teaching method adopted were 72 in number. They had a Likert mean score of 9.31, (SD) 3.18 whilst participants who did not accept the teaching method adopted had a Likert mean score of 20.67, SD 3.32. Z- test analysis revealed a value of 18.19 and a P-value of 0.05, showing a significant difference between the two.

Table 2: Acceptability of the teaching platforms adopted for teaching Orthodontics during the COVID-19 pandemic by Southern Nigerian dental students

Variables	n	Mean	SD	Df	Z Cal	P value	Remarks
Accepted	72	9.31	3.18	116	18.39	0.05	Reject H$_O$ [NS]
Not Accepted	46	20.67	3.32				

P>0.05 NS

Table 3 shows that the challenges experienced in the course of teaching and learning Orthodontics using the adopted platforms were majorly lack of clinical sessions, 53 (45.0%), poor network, 39 responses (33.1%), Inadequate comprehension due to lack of hands-on demonstrations, 7 responses, representing 6.2%. Others include limited access to patients as a precautionary measure/reduction in the number of patients 6(4.8%) and poor/short attention span 11 (9.5%).

Table 3: The challenges faced by students with the teaching platforms adopted in teaching Orthodontics during the COVID-19 pandemic in Southern Nigerian dental schools

Challenges	Number Count	Percentage %
Network Problem	39	33.1%.
Inadequate comprehension due to lack of hands-on demonstration	7	6.2%
Short Attention Span	11	9.5%
Lack of clinical sessions	53	45.0%
Limited access to patients as a precautionary measure	2	1.4%
Reduction in the Number of patients	6	4.8%

Table 4, indicates that the coping strategy adopted was majorly self-directed learning with the majority of the dental students, forty-seven (40%) using this strategy to cope. Twenty (17.2%) used YouTube videos to understand some lectures and seventeen each (14.4%) coped by recording online lectures and forming online tutorial groups respectively. Five (4.2%) of the participants coped by wearing facemasks during physical lectures and twelve of them (10.2%) said their coping strategy was not to learn at all

Table 4: The coping strategies used for the teaching platforms adopted in teaching orthodontics during the COVID-19 pandemic in Southern Nigerian dental schools

Coping Strategies	Number Count	Percentage %
Formation of Online tutorial Groups	17	14.4%.
Use of YouTube Video on some practical topics and to understand some lectures	20	17.2%
Self-directed learning	47	40.0%
By recording the online lectures	17	14.4%
Wearing facemasks during physical lectures	5	4.2%
Not Learning	12	10.2%

DISCUSSION

During the COVID-19 pandemic, for the teaching of Orthodontics to continue, other teaching platforms other than face-to-face were adopted. The participants stated that they had to use platforms like Zoom, WhatsApp, Google Meet, Google Classroom to meet up. WhatsApp happened to be the e-learning

platform with the highest level of utilization (43.4%) followed by Zoom (22.0%). This is similar to the findings by Nur Agung *et al.*, (2020) where WhatsApp was also a highly recommended medium used for online lectures during the COVID-19 pandemic before Google Classroom probably because the end-users; lecturers and students were more familiar with WhatsApp and found it easier to use compared to other on-line devices for learning. It has been reported that WhatsApp works well under poor network signals compared to other online devices, Nur Agung *et al.*, (2020). This is very important for a developing country like Nigeria with a myriad of network challenges. It is pertinent to note that though Google Classroom was next to WhatsApp in the previous study by Nur Agung *et al.*, (2020), in this present study, it came as the third choice of device after Zoom. The finding in this study was in contrast with a previous study by Kamal *et al.*, (2023) where Zoom App was the most popular tool for online classes. Most of the studied participants stated that the lectures they had during the COVID-19 pandemic were through online means. This report shows that the few respondents, (less than a seventh of the participants) who did not have any of the e-learning devices were disadvantaged during the COVID-19 pandemic as they must have lost out on learning. The implication of this is that more training is required and e-learning devices and resources should be made available to forestall similar experiences in the future. During the pandemic, students would have naturally prioritize feeding over purchase of devices and data for online lectures. This finding corroborates a report of previous surveys carried out among 153 dental schools in Europe by the Association for Dental Schools that revealed that non-clinical teaching was performed online in 90% of the schools, Artese (2020) and also most schools in the United States of America converted learning to remote instructions, Iyer *et al.*, (2020). As online learning platforms had to be the source of learning during the COVID-19 pandemic, most of the studied participants were found to have accepted the adopted Orthodontic teaching platforms in the various Southern Nigerian dental schools. This connotes that most of the studied participants saw the various teaching platforms adopted for teaching Orthodontics during the COVID-19 pandemic in Southern-Nigerian dental schools in a good light. For those that did not accept, it could be due to reasons like lack of devices or resources to use for the online lectures, lack of technical support to be able to have the online lectures and lack of socialization associated with physical lectures. Findings in this study, show that most of them did not prefer the face-to-face teaching method that was the norm before the COVID-19 pandemic. This result however, is in contrast to that of Rosenberg *et al.*, (2010), where the students showed unwillingness to replace face-to-face lectures with computer-assisted lectures, and likewise the finding by Beard *et al.*, (2004) which revealed that the students preferred the face-to-face method as it aids students' success due to personal interaction with teachers and their peers. Furthermore, Kelly *et al.*, (2009), reported that face-to-face learning enables rewards, soliciting for viewpoints, humour, and non-verbal expressions like eye contact, gestures, etc. which bring lecturers closer to the learners psychologically. Also in an Algerian University, the students still preferred the traditional pedagogy, and negatively evaluated online learning, and were reluctant to accept the online model of learning during the COVID-19 pandemic (Blizak *et al.*, 2020). Similarly, the current report aligns with that of a Jordan study by Susan *et al.*, (2021) where the students also preferred online lectures, and the report by Gabriella *et al.*, (2023) where the clinical students reported better communication with their teachers and students over on-line sessions and similar learning satisfaction as with classroom learning. In addition, a previous survey by Osgerby, (2013), reported that students preferred online teaching methods as complementary to learning and not as a replacement for the traditional face-to-face method for its step by step instruction manner.

The acceptability seen in this study is also similar to that of studies by Clark *et al.*, (1997) and Aly *et al.*, (2004) that showed more acceptability to computer-assisted learning because computed-assisted learning was said to be useful in the understanding of Orthodontic curriculum.

The situation that ensued during the COVID-19 pandemic was an unprecedented one. Students had varied experiences which were termed challenges. Nigeria was one of the developing countries in the world that was hit unexpectedly by the last pandemic, and dental students had a myriad of challenges they faced as it pertains to their learning. This study revealed some of the challenges faced by the students as regards their Orthodontic learning. Less than half of the studied participants indicated poor network as the second most popular response. This is a common problem in the information technology setting and so this is expected particularly in a country like Nigeria where internet services are not stable. This finding was similar to that of a previous study by Daniel *et al.*, (2020) where the students complained that the quality and stability of the internet connection varied depending on the devices used. Some stated that short attention span was their challenge during that time. This could be due to distractions from the environment they were in, when the online lectures were going on or the liberty to engage in other activities at the same time. Calls and messages getting into the devices being used for online lectures could also be sources of distraction to the students. The challenge of distraction revealed in this study was similar to that found in a previous study by Aguilera-Hermida, (2020) where learners complained of inability to concentrate while at home due to distractors like family members, noise, and house job. Some respondents stated inadequate comprehension of lectures as their challenge since the online lectures cannot be accompanied by a physical demonstration. This is expected since the interaction and explanations from lecturers during face-

to-face lectures aid comprehension. This report is supported by Kumar (2017) who stated that some students need social interaction to perform well academically, so distance learning is difficult for such group of students. Marriot *et al*., (2004) in their study, corroborated this by saying that face-to-face learning facilitates social interaction and communication skills acquired from the classroom environment. In the present study, most participants said their clinical exposure was disturbed and this corroborates a previous study by Susan *et al*., (2021) where most of the students stated that COVID-19 affected their clinical training. For a smooth running of online learning, the lecturers should be compliant with information technology as one can only give what he/she has. Lack of competence on the part of the lecturers in information technology will lead to waste of time during lectures and a waste of data. This concern was supported by the results of Habibu *et al*., (2012) who revealed poor competence of trainers in their research. It is expected that more training would be made available to the lecturers for improved e-learning in the schools.

When people are faced with challenges like those faced during the unplanned COVID-19 pandemic, there must be some coping strategies. Some of the students resulted to self-directed learning which was, a positive outcome of the pandemic. If this becomes a habit, it will be a very useful tool to improved learning, by the students. This finding was similar to the study by Gore *et al.*, (2014) where the students accepted their responsibilities and sought social, and academic ways to keep their learning on-going. Similarly, was the students asking for help from family members and using resources available at home as revealed by Barrot *et al.,* (2021). One-seventh of the respondents resulted to recording on-line lectures as more than a sixth turned to the use of YouTube videos to understand the lectures that were taught. These were positive coping strategies like those reported by Gore *et al*., (2014); Barrot *et al*., (2021). Some of the students resulted, to not learning at all which was not a positive coping strategy. This particular report is in contrast with the finding by Barrot *et al*., (2021) as the students in that survey who lacked resources to participate in online lectures resorted to joining groups that share free resources and consulted with their teachers to overcome their challenges. A negative coping strategy was also seen in previous study by Liang *et al.,* (2012) where the students engaged in self-isolation, taking alcohol and taking drugs.

CONCLUSION

Most of the students accepted the innovative teaching platforms used for teaching Orthodontics during the COVID-19 pandemic. The major challenges faced by the students were lack of clinical sessions followed by a poor network and short attention span. Students at that time resulted to positive coping strategies like self-directed learning and the use of YouTube videos and negative ones like self-isolation, drug and alcohol abuse.

RECOMMENDATIONS

1. The Universities should make it mandatory for trainers to acquire skills in the use of on-line platforms for teaching to be ready for future pandemics to deliver lectures seamlessly.
2. Internet should be made available in the university environment to enable e-learning.
3. E-learning devices can be made available to students and lecturers on an agreement to be paid back gradually.

REFERENCES

- Mohamed, G. H., & Hala, A. (2021). Dental Education in the time of COVID -19 pandemic: Challenges and recommendations. Frontiers in medicine infectious diseases-surveillance, preventive and treatment. https://doi.org/10.3389/fmed 648899.
- Iyer, P., Aziz, K., & Ojcius, D. M. (2020). Impact of COVID-19 on dental education in the United States. *Journal of Dental Education*, 86, 718-722.
- Machado, R. A., Bonan, P. R., Perez, D., & Martelli J. H. (2020). COVID-19 pandemic and the impact on dental education: discussing current and future perspectives. *Brazilian Oral Research*, 34, e083.
- Alzahrani, S. B., Alrusayes, A. A., & Aldossary, M. S. (2020). Impact of COVID-19 pandemic on dental education, research, and students. *Int J Health Sci Res*, *10*(6), 207-212.
- Haroon, Z., Azad, A. A., Sharif, M., Aslam, A., Arshad, K., & Rafiq, S. (2020). COVID-19 era: challenges and solutions in dental education. *J Coll Physicians Surg Pak*, *30*(10), 129-131.
- Shrivastava, K. J., Nahar, R., Parlani, S., & Murthy, V. J. (2022). A cross-sectional virtual survey to evaluate the outcome of online dental education system among undergraduate dental students across India amid COVID-19 pandemic. *European Journal of Dental Education*, *26*(1), 123-130.
- Hung, M., Licari, F. W., Hon, E. S., Lauren, E., Su, S., Birmingham, W. C., ... & Lipsky, M. S. (2021). In an era of uncertainty: Impact of COVID-19 on dental education. *Journal of dental education*, *85*(2), 148-156.
- Bennardo, F., Buffone, C., Fortunato, L., & Giudice, A. (2020). COVID-19 is a challenge for dental education: A commentary. *European Journal of Dental Education, 24,* 822-824.
- Galibourg, A., Maret, D., Monsarat, P., & Nasr, K. (2020). Impact of COVID-19 on dental education: how could pre-clinical training be done at home? *Journal of Dental Education*, 84, 949.
- Cheng, H., Lu, S., Yen, Y., Siew-Chaisakul, P., Yen, M., & Chen, S. L. (2021) Dental education changed by covid-19: Student's perceptions and attitudes. *BMC Medical Education*, 21. https://doiorg/10.1186/s12909-021-02806-5.
- Agung, A. S. N., Surtikanti, M. W., & Quinones, C. A. (2020). Students' perception of online learning

during COVID-19 pandemic: A case study on the English students of STKIP Pamane Talino. *SOSHUM: Jurnal Sosial Dan Humaniora*, *10*(2), 225-235.

- Kamal, T., Khan, M. A., Hamad, Z, Illiyan, A., Das, A. K., & Alkhuraydili, A. (2023). Perception and challenges of virtual classes with Gender Digital Divide amidst and Post COVID-19 pandemic in Iraq: An empirical Analysis. *Education Research International*, 1-14.

- Artese, F. (2020). Covid-19 pandemic unveiling the opportunities and challenges in orthodontic training. *Dental Press Journal of Orthodontics, 25*, 7-8.

- Rosenberg, H., Posluns, J., Tenenbaum, H. C., Tompson, B., & Locker, D. (2010). Evaluation of computer-aided learning in orthodontics. *American journal of orthodontics and dentofacial orthopedics*, *138*(4), 410-419.

- Beard, L. A., Harper, C., & Riley, G. (2004). Online versus on-campus instruction: Student attitudes and perceptions. *Tech Trends*, 48, 29-31.

- Kelley, D. H., & Gorham. (2009). Effects of immediacy on recall of information. *Communication Education*, 37, 198-207.

- Blizak, D., Blizak, S., Bouchenak, O., & Yahiaoui, K. (2020). Students' perceptions regarding the abrupt transition to on-line learning during the COVID-19 pandemic: Case of faulty of Chemistry and hydrocarbons at the University of Boumerdes-Algeria. *Journal of Chemical Education*, 97, 2466-2471.

- Susan, H., Abeer, A., Faleh, S., Islam, A., Ahmad, E., & Fouad, W. (2021). Impact of COVID-19 pandemic on dental education: online experience and practice expectations among dental students at the University of Jordan. *BMC Medical Education*, 21, 151.

- Gabriela, J. P., Zychova, K., Drahotova, K., Kuralova, K., Stanislavska, L. K., & Pilar, L. (2023). Identifying the communication of burnout syndrome on the twitter platform from the individual, organizational and environmental perspective. *Frontiers in Psychology*, 14, 1-17.

- Osgerby, J. (2013). Students; perceptions of the introduction of a blended learning environment: An

exploratory case study. *Accounting Education*, 22, 85-99.

- Clark, R. D., Weekrakone, S., & Rock, W. P. (1997). A hypertext tutorial for teaching cephalometrics. *British Journal of Orthodontics*, 24, 325-328.

- Aly, M., Elen, J., & Willems, G. (2004). Instructional multimedia program versus standard lecture: A Comparison of two methods for teaching the undergraduate orthodontic curriculum. *European Journal of Dental Education,* 8, 43-46.

- Daniel, C., Adrian, G., Carmen, D., & Mauricio, M. (2020). E-learning in Dental schools in the Times of Covid-19: A review and Analysis of an Educational Resource in Times of the Covid-19 pandemic. *International Journal of Dental Science*, 22, 69-86.

- Aguilera-Hermida, P. (2020). College students' use and acceptance of emergence on-line learning due to COVID-19. *International Journal of Educational Research Open*. https://doi.org/10.1016/j.ijedro.2020.100011.

- Kumar, A. (2017). E-learning and blended learning in Orthodontic education. *APOS Trends Orthod*, 7, 188-198.

- Marriot, N., Marriot, P., & Selwyn. (2004). Accounting undergraduates changing use of ICT and their views on using the internet in higher education-A research note. *Accounting Education*, 13, 117-130.

- Habibu, T., Abdullah-Al-Mamun, M., & Clement, C. (2012). Difficulties faced by lecturers in using ICT in teaching-learning at technical and higher educational institutions of Uganda. *International Journal of Engineering Research and Technology*, 1, 1-10.

- Gore, F., Bloem, P. J. N., Patton, G. C., Ferguson, J., & Joseph, V. (2014). Global burden of disease in young people aged 10-24 years: a systematic analysis. Routeledge.

- Barrot J. S., Llenares I. I., & Del Rosario L. S. (2021). Students' online learning challenges during the pandemic and how they cope with them: The case of the Philippines. *Education and Information Technologies, 26,* 7321-7338.

- Liang, R. Y. H., & Chen, D. T. (2012). Online learning: Trends, potential and challenges.