Twelve tips for creating online learning units for the health professions in low- and middle-income countries

Karli Brittz[a,*], Yvonne Botma[b] and Tanya Heyns[c]

[a]School of the Arts, University of Gauteng, Pretoria South Africa;
[b]School of Nursing, University of the Free State, Bloemfontein, SouthAfrica;
[c]Department of Nursing Sciences, School of Health Care Sciences, University of Pretoria, South Africa

*CONTACT Karli Brittz. School of the Arts, Digital Culture & Media, University of Pretoria, Lynnwood Road, Pretoria, South Africa. Email: karlibrittz@gmail.com

Abstract

Health professions educators in low-and middle-income countries are often sceptical about developing online learning units. This scepticism stems from the belief that online programmes are limited in developing clinical competence, and there are concerns about digital proficiency and resource availability. A social constructivist approach in designing online work-based learning units may overcome such scepticism. In this article, we use our experience in developing an online learning unit for healthcare education to suggest 12 tips for developing online learning units in a low-and middle-income context. The tips are nested in a 'promoting theory-practice integration framework' and include context, establishing communities of learning and practice, establishing foundational knowledge, practise in a work-based environment, and showcasing attainment of learning outcomes. By integrating the guidelines and framework, healthcare educators will be better equipped to develop online learning units and contribute to learning.

Keywords: Constructivism; low-andmiddle-income countries;online learning; work-base

Introduction

Health professions educators are often sceptical about online learning units, because they doubt that these units develop clinical competence among healthcare students and professionals (Delva et al. 2019; Gemuhay et al. 2019; Mutua and Nyoni 2023). Recent developments such as increased internet connectivity, technological advancements, and the COVID-19 pandemic have necessitated the rapid uptake and development of online learning units by health professionals (Yangoz et al. 2017; Affouneh et al. 2020; Ananga 2020; Lemay et al. 2021). Online learning has the advantage of providing greater flexibility regarding time, space, language, content, and administrative power than traditional face-to-face learning (De Leeuw et al. 2018). Therefore, it is inevitable that healthcare students and professionals will use online learning tools. In contrast to high-income countries, low- and middle-income countries experience barriers to online learning such as connectivity issues and unaffordability,

Table 1. Summary of the 12 tips within the constructs of the transfer of learning framework.

Constructs	Related tips
Context	Tip 1: Use an interprofessional team to develop the online unit
	Tip 2: Select a learning management system that is accessible *via* mobile devices
	Tip 3: Implement a bandwidth efficiency strategy
	Tip 4: Include context-specific and culturally relevant learning material
	Tip 5: Implement an accessible approach to content
Community of learning	Tip 6: Design for a community of learning to support students and health educators in the online environment
Activate existing knowledge	Tip 7: Use participatory tools to engage students
Engage with new knowledge	Tip 8: Design for success by ensuring that content is short, to-the-point, and exciting
	Tip 9: Incorporate existing content from available platforms to engage students
Practise integration	Tip 10: Focus on relevance and a blended learning approach to content
Apply in real world	Tip 11: Allow for frequent assessment and reflection based on real world situations
Attain outcomes	Tip 12: Incorporate an E-portfolio to showcase learning accomplishments

which may contribute to educators' hesitance to implementing such units (Qazi et al. 2020; Maphosa et al. 2022). Online learning is in its infancy in Africa but has been heralded as a revolutionary force for health education especially in low-resource countries (Barteit et al. 2019; Kibuku et al. 2020). Although certain educators have not fully embraced online learning, students are more receptive to its modalities, which will influence their knowledge and behavioural outcomes (Bahrambeygi et al. 2018). Most curricula in low-and middle-income countries are content-based, whereas online learning is student-centred (Mutua and Nyoni 2023), requiring educators to change their teaching and learning approach. Educators should recognise that content-based curricula may be decontextualised, while online learning presents an opportunity for contextual, work-based curricula.

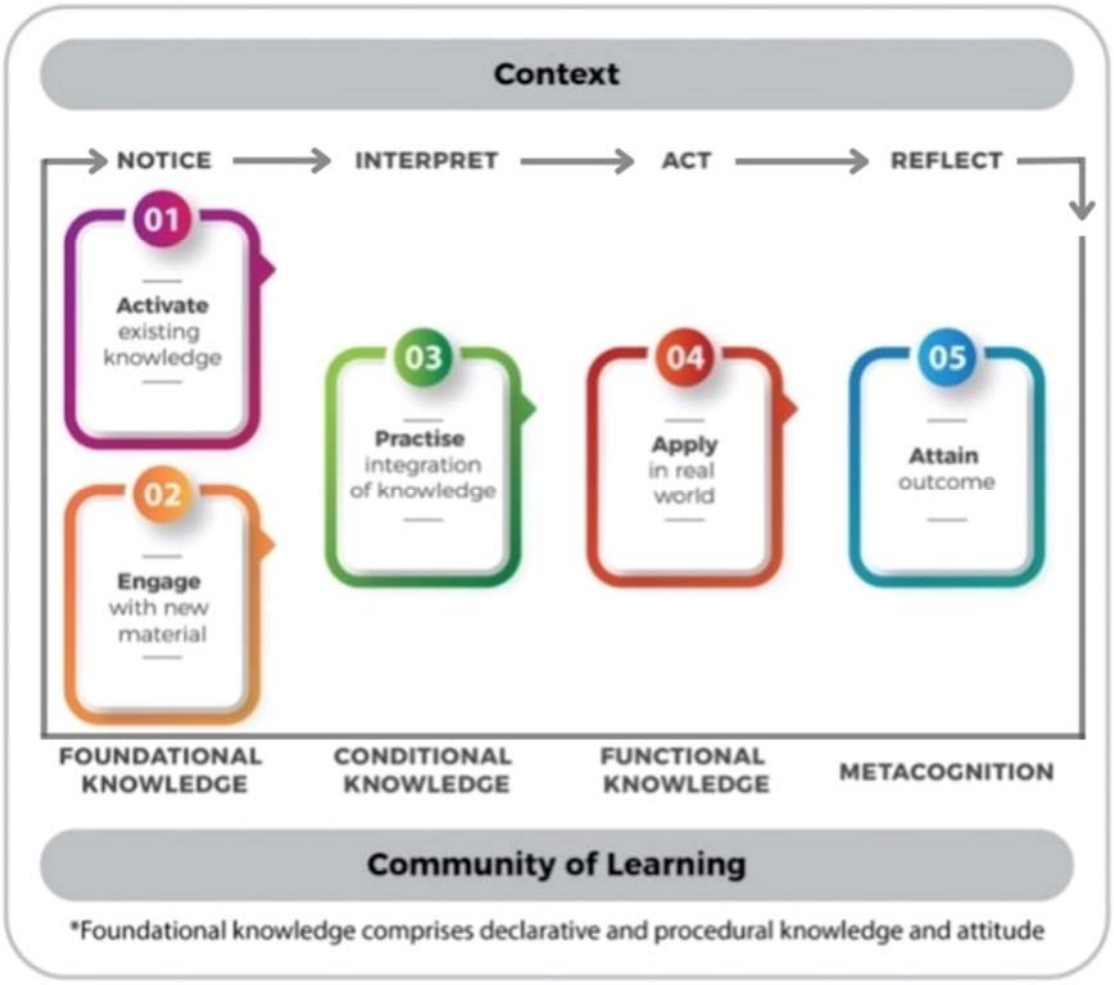

Figure 1. Conceptual framework to promote theory-practice integration.

To address health educators' scepticism surrounding online learning units, we share our experiences, with literature support, in designing accessible and affordable online learning units in low-and middle-income contexts. The tips are aligned with the transfer of learning conceptual framework developed by Botma and Heyns based on the work of Biggs (1999), Tanner (2006), and Botma et al. (2013) (Figure 1).

The conceptual framework is embedded in the constructivist learning theory and the health sciences. Social constructivism implies that learning occurs when people interact to attain learning outcomes (Botma et al. 2013). The 12 tips are embedded in active learning, collaboration, multiple perspectives, reflection and authenticity, which are the pillars of social constructivism (Archambault et al. 2022). Despite the linear depiction, the framework demonstrates that theory-practice integration is an iterative cyclic process encompassing the phases of notice, interpret, act and reflect, within the broader categories of context, a community of learning, foundational knowledge, work-based practise, and attaining learning outcomes. The phases are reoccurring and repetitive in nature.

The community of learning refers to everybody contributing to student learning including lecturers, clinical facilitators, patients, and physiotherapists, among others. The community of learning helps to establish foundational, conditional, and functional knowledge. Foundational knowledge is knowing 'what is' (declarative knowledge) and 'how to do things' (procedural knowledge) (Biggs 1999; Anderson et al. 2001; Rittle-Johnson and Schneider 2015), which, in turn, enables students to notice and explain deviations from the norm (Tanner 2006). Clinical reasoning equates to conditional knowledge (knowing when to do things), allowing interpretation of data, recognition of patterns, and formulation of differential diagnoses or a diagnosis (Swan et al. 2020). Clinical judgement portrays functional knowledge and allows students to apply all levels of knowledge in clinical practice (Tanner 2006). Reflective practice, or metacognition, is invaluable for reflecting on thinking processes and realising and evaluating outcomes (Botma et al. 2013). With every case, reflecting in and on action enables students to notice new clinical manifestations, necessitating interpretation and actions, which is a cyclical process. As the framework indicates, knowledge application is contextual (for example, primary healthcare or intensive care) and situational (for example, heart failure or pneumonia); therefore, educators should guide students in applying their foundational knowledge in specific contexts (Botma et al. 2013). In doing so, existing schemas should be recalled and linked to new knowledge through active engagement with learning material (Botma et al. 2013).

Here, we present 12 tips that could encourage and facilitate the development of online learning units for health professions in low-and middle-income countries. The 12 tips align with the elements of the conceptual framework for the transfer of learning (Table 1).

Tip 1

Use interprofessional teams to develop online learning units

Educators from various backgrounds apply their knowledge and skills in unique ways to create innovative environments, which promotes the reuse of materials and the sharing of ideas (Lopes et al. 2022). Creating interprofessional teams in low-and middle-income countries will also contribute to lowering costs. Interprofessional teams should include content experts (health professionals), educational experts and IT specialists. Teams allow for additional layers of evaluation of online units, for example when assessing utility and developing content (Lopes et al. 2022). The team approach overcomes difficulties such as insufficient technical skills, time constraints, lack of content knowledge, and reluctance to engage with online learning (Gachanja et al. 2021).

Tip 2

Select a learning management system that is accessible via mobile devices

Successful online learning depends on the effective implementation of learning management systems (LMSs) – also known as virtual learning environments (VLEs) or e-learning platforms (Alameen and Dhupia 2019; Zhang et al. 2020). An LMS is a software application or web-based system that allows students to access asynchronous, synchronous, and administrative learning content from anywhere, at any time (Ferdianto and Dwiniasih 2019). With the emergence of e-learning and blended learning, a variety of LMSs have become popular including Blackboard Learn, Moodle, and Schoology. However, many of these LMSs do not consider specific contexts and are expensive (Martin and Reyes 2023). To overcome economic barriers in low-and middle-income countries, educators could employ one of the many open-source LMSs that are available and easily accessible with a variety of functions (Cavus and Zabadi 2014). Although some have limited features, freely available LMSs have the same basic functionalities as paid-for versions and can provide an easily accessible and user-friendly virtual environment for learning. Some examples include Canvas, Edmondo, and Google Classroom. These platforms are usually also supported by mobile phones and other handheld devices, increasing accessibility for low-and middle-income health workers who may not always have access to desktop computers. Educators should focus on selecting an LMS that is user-friendly and free or open source to structure a cost-effective and accessible virtual environment. Social media applications, such as Facebook and Twitter (Salmon et al. 2015), have similar functionalities as LMSs and can be used to scaffold content, host asynchronous and synchronous discussions, and administer an e-learning platform (Salmon et al. 2015; Agarwal and Alrowaili 2020; Mpungose 2020). Additionally, LMSs should facilitate engagement and communication rather than archive information. Thus, when selecting an LMS, educators should avoid paying for additional storage. If the platform allows for effective scaffolding and communication, it will be sufficient.

Tip 3

Implement a bandwidth efficiency strategy

The use of online platforms in low-and middle-income countries is often constrained by low bandwidth environments as well as limited access to the internet and data (Jordan et al. 2021). Developers should employ an overall 'bandwidth friendly' and efficient strategy to ensure that the VLE can operate in the context of high data costs and potential connectivity issues (Suhail et al. 2013; Ana-Paula 2020). Bandwidth usage can be optimized by limiting the size of documents and resources shared (Suhail et al. 2013). To improve 'bandwidth friendliness', documents could be saved in low quality or resolution format; links to videos could be inserted into LMSs, rather than uploading the videos directly; using graphics software that resizes images for screen viewing (for example, Shrink Pictures); and using a solid white background with dark text, instead of colourful background images. Students should be able to access content whenever an internet connection is available and be able to download content for later viewing.

Tip 4

Include context-specific and culturally relevant learning material

Since effective learning depends on context (Osika et al. 2022), educators should incorporate context-specific learning instead of simply reverting to generalised material. Context and culturally specific content create meaningful, engaging learning experiences (Osika et al. 2022). Popular culture references can also be incorporated to promote critical thinking (Peacock et al. 2018), experiential learning (Kirkpatrick 2001), and foster engagement and curiosity (Jubas 2022). When using popular culture resources, educators should ensure that visual content and examples represent the culture, demographics, economic status, and customs of the students. An example from an episode of the American television show *Grey's Anatomy* (Rhimes 2005) might illustrate a concept efficiently, but it will not represent the circumstantial reality of healthcare in low-and middle-income countries.

Tip 5

Implement an accessible approach to content

When scheduling and releasing course content, a free-form approach is better suited to low-and middle-income environments. A free-form approach involves flexible, adaptable timelines, as well as enduring content (Al Rawashdeh et al. 2021). Although a free-form approach can be unpredictable and requires self-discipline from the student, in low-and middle-income environments, students benefit from having the freedom to work through content at their own pace, because they do not always have connectivity or might complete the online learning unit after working hours. Hariadi and Simanjuntak (2020) argue that deadlines are an important barrier causing students to

struggle with online learning. A free-form approach will encourage students to be disciplined in completing activities and mastering skills, while recognising each individual's unique circumstances and needs when completing online learning units.

Tip 6

Design for a community of learning to support students and health educators in the online environment

An online community of learning comprises socially, cognitively, and emotionally engaged students, which is of great importance to students' success (Richardson et al. 2017). Furthermore, online communities have a positive effect on the quality of learning and encourages student motivation (Fiock 2020). A clear pattern or sequence of learning should be established and repeated for each theme. Such patterns and sequences allow students to focus on learning and content, reducing their cognitive load (Masava et al. 2023). Educators should design activities that engage students socially and emotionally, for example by using a welcoming introduction, asking students to add photos and profiles, structured learning activities that include collaborative learning activities and teamwork, activities that incorporate students' feelings and personal experiences, and opportunities for both peer-to-peer and peer-to-facilitator connections (Richardson et al. 2017). Health educators should facilitate online learning through programme announcements, weekly overviews, prompt feedback, embedding personal insight in the programme material, scaffolding, facilitating discourse, and checking for accurate student understanding. Such facilitator presence is crucial for the success of an online programme (Richardson et al. 2017).

Tip 7

Use participatory tools to engage students

The previous tip explained how to design for participation and in this tip we discuss participatory tools to support an online community. Online participatory tools may create an engaging experience with a focus on community development and collaboration. Several free online tools or add-on applications exist that can easily be built into an LMS to enable participation in activities and discussions (Mahtani et al. 2022). These tools allow students and peers to interact in a virtual space (Goldberg 2020). Participatory tools can also be used to add an element of excitement to enhance collaboration and extend beyond the typical question-response format of an online discussion board. For example, participatory visual boards, such as Padlet, can be embedded into an LMS page. Students can add videos, images, recordings, links, and text to the board, resulting in creative discussions (Goldberg 2020). Live polling tools can also be used to measure responses, opinions, and feedback from students in real time. For instance, Mentimeter can be used as an instant learning and assessment tool, enabling facilitators to alter future content according to student needs while enhancing teamwork (Vallely and Gibson 2018). Additionally, game-based learning applications can have a positive effect on learning performance, student

dynamics, anxiety, and motivation (Tahir and Wang 2020). Emotional engagement can be fostered by using Blobs, where students critically reflect on their progress by identifying with figures representing various feelings and situations (Wilson and Long 2018; Martin 2021). Adding a tool such as Kahoot! to facilitate discussions, collect information, test knowledge, or reveal emotions creates an interactive environment that makes learning interesting and fun.

Tip 8

Design for success by ensuring that content is short, to-the-point, and exciting

Educators should design online learning units that are informative, easy to read, short, and interesting (Foulds 2022). When developing and choosing material to include in online learning units, content should be evidence-based, draw attention, and give a clear and concise overview of the content. Educators should use infographics, highlight key words, and provide bulleted content to avoid bombarding students with too much information. In an online learning environment, the principle of 'less is more' enables students' engagement, which increases their foundational knowledge. Furthermore, student engagement leads to improved learning and influences students' academic development positively (Qureshi et al. 2023). Specifically, videos and visual material should be short and combine graphics, audio, and text in a fast-paced manner to keep interest. Video content works best if approached as microlearning or 'mini-lectures', which are short presentations of no more than eight minutes that focus on one particular topic (Scagnoli et al. 2015). Short videos reduce cognitive load and enhance retention (Afify 2019). Short and focused material further increases student satisfaction during online learning (Scagnoli et al. 2015). Developers also require less time to create shorter content, which is also easier to adapt and adjust (Giurgiu 2017).

Tip 9

Incorporate existing content from available platforms to engage students

Educators can incorporate existing, freely available material into online learning units. Web-based content, open-education resources (Otto 2019), and social networking sites, such as blogs, podcasts, wikis (Reinhardt 2019), and YouTube videos (Curran et al. 2020) allows for accessible sharing and activation of knowledge. Existing material can be kept as a resource, presented as further enrichment, or adapted to consolidate learning. For instance, students can be asked to reflect, discuss, or critically consider content and their feedback should be considered in adapting the existing material (Fawns and Sinclair 2022). Short questions and quizzes can also be built into the material. Incorporating existing content saves money and time and encourages a multimedia delivery strategy and engaging approach to online learning (Curran et al. 2020). Educators should act within the copy right legislation when using existing content.

Tip 10

Focus on relevance and a blended learning approach to content

Students should be able to apply and practice their knowledge in their own relevant working context . Such a work-based approach is a helpful learning strategy for online learning, because it emphasises the relevance of the learning material (Chapman 2006; Abukari and Ahmed 2019; Witter et al. 2022). A work-based approach saves costs and has proven to be effective in specific healthcare contexts because there is a need for practical, skills-based training (Bakar et al. 2022). Students can for example bring work-based cases to class for discussion and learning, within ethical parameters. Adopting a work-based approach allows healthcare professionals to access online resources, learn while they work, and review their development at their own pace (Attenborough et al. 2019).

Tip 11

Allow for frequent assessment and reflection based on real-world situations

Online learning units should incorporate several opportunities for assessment so that students can constantly reflect on their progress and development. Short assessment activities can be integrated to achieve key work-based learning outcomes. Deliverables that include evidence of achieved learning outcomes can serve as a measure of progress. These activities should not be tedious and can involve short, fun questions and discussion points that apply to the real world. For example, the Blob Tree psycho-analyst test developed by Pip Wilson can be used to pose reflection questions and discussions on progress made (Wilson and Long 2018, Martin 2021). In a VLE, students can easily reflect on their progress using online blog entries or short discussion forums.

Tip 12

Incorporate an E-portfolio to showcase learning accomplishments

An E-portfolio could be implemented as an assessment strategy to assess work-based activities, keep track of professional development, and evaluate exit learning outcomes. Creating an E-portfolio does not need to be a costly assessment strategy, and in a low-and middle-income context, portfolios have the benefit of being more flexible than summative assessments and give students more opportunities to succeed (Buzzetto-More 2010; Yang et al. 2016). Students should be responsible for collating the evidence of their achievements in their portfolios on a personal online platform (Siddiqui et al. 2023). Evidence can include reports, reflections, self-assessments, evaluations, and references. E-portfolios allow students to assemble evidence in their own time as circumstances allow, eliminating barriers that might occur in a more formal setting such as transportation, time constraints, and connectivity issues. Additionally, E-portfolios can be created within LMSs and set up

in such a way that the student can export the final portfolio for further use in their career. Other applications outside of the LMS, for example, Microsoft OneNote Class Notebook (Flynn 2022), WordPress (Avila et al. 2016), and social media platforms (Oh et al. 2020), can also be used, which can then, in turn, be uploaded to LMSs. Typically, online platforms should allow for embedding images, audio, and videos; uploading files; as well as adding hyperlinks and text (Flynn 2022). Since E-portfolios can be structured in various ways, students should be given clear instructions on the format of information and which media should be used; where the student should reflect on progress (critical self-evaluation); and in what way the portfolio will be assessed by providing rubrics. For more tips on integrating E-portfolios in health professions education see Siddiqui et al. (2023).

Conclusion

Although online learning remains content-based and in its infancy in low-and middle-income countries, the accessibility of free online LMS and participatory tools may improve the affordability and availability of such units. Online learning units should be mapped using models such as the transfer of learning framework. The learning framework is embedded in active learning, collaboration, multiple perspectives, reflection and authenticity, which are the pillars of social constructivism. Based on the authors' experiences using these tips in online learning practices in a low- and middle-income setting, the presented 12 tips may help educators when planning and implementing work-based online learning units that showcase the relevance of the competencies gained. A recommendation is that standardised tools be used to evaluate the effectiveness of online programmes that implemented the tips.

Disclosure statement

The authors report there are no competing interests to declare.

Funding

This work was supported by the National Research Foundation [138461].

Notes on contributors

Karli Brittz is a scholar in digital culture and media studies. She is a postdoctoral candidate in the School of the Arts at the University of Pretoria, where she teaches Visual Culture Studies and Digital Culture and Media. Karli obtained a PhD in Visual Studies from the School of the Arts at the University of Pretoria. Karli received the NIHSS award for best digital humanities visualisation project in 2021. Her main research and teaching interests are the complexities of being human in the digital age, as well as critically considering digital culture in relation to teaching and learning.

Yvonne Botma is an emeritus professor at the School of Nursing, University of the Free State. Her research focuses on the transfer of learning, specifically the

educational design component of the transfer of learning model. The design element includes simulation, virtual realities, and online learning.

Tanya Heyns is a professor at the Department of Nursing Science, University of Pretoria, South Africa. Her educational involvement includes the education and training of post-graduate programmes, focussing predominantly on Critical Care Nursing, including Emergency Nursing. She completed her PhD at the University of South Africa in 2008 and specialised in critical care and emergency care nursing. Tanya's research interest lies in the area of practice development.

References

Abukari A, Ahmed BK. 2019. Integrating work-based learning into open distance learning in higher education – examining the prospects in a developing context from a student perspective. Res in Post-Compuls Educ. 24(1):102–128. doi: 10.1080/13596748.2018.1526910.

Affouneh S, Salha S, Khlaif N. 2020. Designing quality e-learning environments for emergency remote teaching in Coronavirus crisis. Interdiscip J Virtual Learn Med Sci. 11(2):135–137.

Afify MK. 2019. Effects of interactive video length within e-learning environments on cognitive load, cognitive achievement and retention of learning. Turkish Online J Distance Educ. 21(4):68–89.

Agarwal A, Alrowaili MG. 2020. Prospects and challenges of social media (WhatsApp) usage over university learning management system (LMS) as an e-learning tool among university students, Kingdom of Saudi Arabia (KSA). P J M H S. 14(2):818–828.

Al Rawashdeh AZ, Mohammed EY, Al Arab AR, Alara M, Al-Rawashdeh B, Al-Rawashdeh B. 2021. Advantages and disadvantages of using e-learning in university wducation: analyzing students' perspectives. EJEL. 19(3):107–117. doi: 10.34190/ejel.19.3.2168.

Alameen A, Dhupia B. 2019. Implementing adaptive e-learning conceptual model: a survey and comparison with open source LMS. Int. J. Emerg. Technol. Learn. 14(21):28–45. doi: 10.3991/ijet.v14i21.11030.

Ananga P. 2020. Pedagogical considerations of e-learning in education for development in the face of COVID-19. IJTES. 4(4):310–321. doi: 10.46328/ijtes.v4i4.123.

Ana-Paula C. 2020. Healing the digital divide during the COVID-19 pandemic. Q J Distance Educ. 21(1):13–21.

Anderson LW, Krathwohl DR, Airasian PW, Cruikshank KA, Mayer RE, Pintrich PR, Raths J, Wittrock MC. 2001. A taxonomy for learning, teaching and assessing: a revision of Bloom's taxonomy of educational objectives. New York: Longman.

Archambault L, Leary H, Rice K. 2022. Pillars of online pedagogy: a framework for teaching in online learning environments. Educ Psych. 57(3):178–191. doi: 10.1080/00461520.2022.2051513.

Attenborough J, Abbott S, Brook J, Knight RA. 2019. Everywhere and nowhere: work-based learning in healthcare education. Nurse Educ Pract. 36:132–138. doi: 10.1016/j.nepr.2019.03.004.

Avila J, Sostmann K, Breckwoldt J, Peters H. 2016. Evaluation of the free, open source software WordPress as electronic portfolio system in undergraduate medical education. BMC Med Educ. 16(1):157. doi: 10.1186/s12909-016-0678-1.

Bahrambeygi F, Shojaeizadeh D, Sadeghi R, Nasiri S, Ghazanchaei E. 2018. The effectiveness of an e-learning program on nurse's knowledge and behaviour for caring of patients with Thromboembolism: a comparative study. J Nurs and Healthc Manag. 1:105.

Bakar YIA, Hassan A, Sulon HAM, Yusoff MSB, Kasim F, Hadie SNH. 2022. The benefits and challenges of clinical work-based surface anatomy among preclinical medical students. Mal J Med Health Sci. 18(2):173–180.

Barteit S, Jahn A, Banda SS, Bärnighausen T, Bowa A, Chileshe G, Guzek D, Jorge MM, Lüders S, Malunga G, et al. 2019. E-learning for medical education in Sub-Saharan Africa and low-resource settings: viewpoint. J Med Internet Res. 21(1):e12449.,. doi: 10.2196/12449.

Biggs J. 1999. What the student does: teaching for enhanced learning. High Educ Res & Dev. 18(1):57–75. doi: 10.1080/0729436990180105.

Botma Y, Brysiewicz P, Chipps J, Mthembu S, Phillips M. 2013. Creating stimulating learning opportunities. Cape Town: Pearson.

Buzzetto-More N. 2010. Assessing the efficacy and effectiveness of an e-portfolio used for summative assessment. Interdiscip J E-Learn Learn Objects. 6(1):61. −85.

Cavus N, Zabadi T. 2014. A comparison of open source learning management systems. Procedia – Soc and Behav Sci. 143:521–526. doi: 10.1016/j.sbspro.2014.07.430.

Chapman L. 2006. Improving patient care through work-based learning. Nurs STD. 20(41):41–45. doi: 10.7748/ns.20.41.41.s58.

Curran V, Simmons K, Matthews L, Fleet L, Gustafson DL, Fairbridge NA, Xu X. 2020. YouTube as an education resource in medical education: a scoping review. Med Sci Educ. 30(4):1775–1782. doi: 10.1007/s40670-020-01016-w.

De Leeuw RA, Walsh K, Westerman M, Scheele F. 2018. Consensus on quality indicators of postgraduate medical e-learning: delphi study. JMIR Med Educ. 4(1):e13. doi: 10.2196/mededu.9365.

Delva S, Nkimbeng M, Chow S, Renda S, Han H-R, D'Aoust R. 2019. Views of regulatory authorities on standards to assure quality in online nursing education. Nurs Outlook. 67(6):747–759. doi: 10.1016/j.outlook.2019.06.011.

Fawns T, Sinclair C. 2022. Online Postgraduate Education in a Postdigital World: beyond Technology. Cham: Springer International Publishing.

Ferdianto F, Dwiniasih. 2019. J Phys: conf Ser. 1360 Learning management system (LMS) schoology: why it's important and what it looks like; p.1-6.

Fiock H. 2020. Designing a community of inquiry in online courses. The Int Rev Res Open and Distrib Learn. 21(1):135–153.

Flynn CO. 2022. Reflection on an e-portfolio assessment in a first-year physiology course. Biomed Eng Educ. 2(1):61–67. doi: 10.1007/s43683-021-00058-9.

Foulds O. 2022. Investigating how word clutter and colour impact upon learning. In: Ifenthaler D, Isaías P, Sampson DG, editors. Orchestration of Learning Environments in the Digital World. Cognition and Exploratory Learning in the Digital Age. Cham: Springer; p. 135–151.

Gachanja F, Mwangi N, Gicheru W. 2021. E-learning in medical education during COVID-19 pandemic: experiences of a research course at Kenya Medical Training College. BMC Med Educ. 21(1):612. doi: 10.1186/s12909-021-03050-7.

Gemuhay HM, Kalolo A, Mirisho R, Chipwaza B, Nyangena E. 2019. Factors affecting performance in clinical practice among perservice diploma nursing students in Northern Tanzania. Nurs Res Pract. 2019:3453085. 3453085. doi: 10.1155/2019/3453085.

Giurgiu L. 2017. Microlearning an evolving elearning trend. Sci Bull. 22(1):18–23. doi: 10.1515/bsaft-2017-0003.

Goldberg C. 2020. 3 tech tools to increase participation in virtual discussions. [NY (US)]: Online Education for Higher Ed; [accessed 2023 May 9]. https://blogs.onlineeducation.touro.edu/3-tech-tools-to-increase-participation-in-virtual-discussions/(open in a new window).

Hariadi IG, Simanjuntak DC. 2020. Exploring the experience of EFL students engaged in asynchronous e-learning. AJP. 8(2):72–86. doi: 10.33603/perspective.v8i2.4194.

Jordan K, David R, Phillips T, Pellini A. 2021. Education during the Covid-19 crisis: opportunities and constraints of using EdTech in low-income countries. Rev de Educ a Distancia. 65(21):1–15.

Jubas K. 2022. Using popular culture in professional education to foster critical curiosity and learning. Stud in Educ of Adults [accessed 2023 May 16];[19. p.]. doi: 10.1080/02660830.2022.2114690.

Kibuku RN, Ochieng DO, Wausi AN. 2020. e-Learning challenges faced by universities in Kenya: a literature review. Electr J e-Learn. 18(2):150. −161.

Kirkpatrick MK, Brown ST, Atkins A, Vance A. 2001. Using popular culture to teach nursing leadership. J Nurs Educ. 40(2):90–92. doi: 10.3928/0148-4834-20010201-09.

Lemay DJ, Bazelais P, Doleck T. 2021. Transition to online learning during the COVID-19 pandemic. Comput in Hum Behav Rep. 4:1–9.

Lopes C, Bernardes Ó, Goncalves MJA, Terra AL, da Silva MM, Tavares C, Valente I. 2022. E-learning enhancement through multidisciplinary teams in higher education: students, teachers, and librarians. Educ Sci. 12(9):601. doi: 10.3390/educsci12090601.

Mahtani R, Gill C, Umstead K, Behnam AS, Tully KP. 2022. Online participatory tools in classroom and research settings. Paper presented at: LSBU 2022. Proceedings of the International Conference on Engineering and Product Design Education; Sep 8 − 9; London, UK.

Maphosa C, Rugube T, Mthethwa-Kunene KE, Dlamini P. 2022. Understanding the experienced opportunities and threats of online learning in a professional development programme. EJEDU. 3(3):242–250. doi: 10.24018/ejedu.2022.3.3.366.

Martin AS, Reyes MM. 2023. A collaborative learning platform for corporate training of Small and Medium Enterprises: a tool for increasing company productivity. R.A.N. 9(1):113–126.

Martin J. 2021. “I didn’t know it was normal”: how student stress, anxiety, and confidence during Covid-19 influence student wellbeing. herourou. 1(1):30–50. −31. doi: 10.54474/herourou.1.1.2920214.

Masava B, Nyoni CN, Botma Y. 2023. Scaffolding in health sciences education programmes: an integrative review. Med Sci Educ. 33(1):255–273. − doi: 10.1007/s40670-022-01691-x.

Mpungose CE. 2020. Are social media sites a platform for formal or informal learning? Students’ experiences in institutions of higher education. IJHE. 9(5):300–311. doi: 10.5430/ijhe.v9n5p300.

Mutua MM, Nyoni CN. 2023. Undergraduate e-learning programmes in health professions: an integrative review of evaluation standards in low- and middle-income countries. PLoS One. 18(2):e0281586. −. doi: 10.1371/journal.pone.0281586.

Oh J, Chan YK, Kim KV. 2020. Social media and e-portfolios: impacting design students’ motivation through project-based learning. ije. 8(3):41–58. doi: 10.22492/ije.8.3.03.

Osika A, MacMahon S, Lodge JM, Carroll A. 2022. Contextual learning: linking learning to the real world. [Queensland (New Zeeland)]: Times Higher Education; [accessed 2023 March 8]. https://www.timeshighereducation.com/campus/contextual-learning-linking-learning-real-world

Otto D. 2019. Adoption and diffusion of open education resources (OER) in education: a m eta-analysis of 25 OER-Projects. Int Rev Res Open Distrib Learn. 20(5):122–140.

Peacock J, Covino R, Auchter J, Boyd J, Klug H, Laing C, Irvin L. 2018. University faculty perceptions and utilization of popular culture in the classroom. Stud in High Educ. 43(4):601–613. doi: 10.1080/03075079.2016.1180673.

Qazi A, Naseer K, Qazi J, AlSalman H, Naseem U, Yang S, Hardaker G, Gumaei A. 2020. Conventional to online education during COVID-19 pandemic: do develop and underdeveloped nations cope alike. Child Youth Serv Rev. 119:105582. doi: 10.1016/j.childyouth.2020.105582.

Qureshi MA, Khaskheli A, Qureshi JA, Raza SA, Yousufi SQ. 2023. Factors affecting students’ learning performance through collaborative learning and engagement. Interact Learn Environ. 31(4):2371–2391. doi: 10.1080/10494820.2021.1884886.

Rhimes S. 2005. Grey’s Anatomy [television series]. Rhimes S, creator and producer. ABC.

Reinhardt J. 2019. Social media in second and foreign language teaching and learning: blogs, wikis and social networking. Lang. Teach. 52(1):1–39. doi: 10.1017/S0261444818000356.

Richardson JC, Maeda Y, Lv J, Caskurlu S. 2017. Social presence in relation to students' satisfaction and learning in the online environment: a meta-analysis. Comput in Hum Behav. 71:402–417. doi: 10.1016/j.chb.2017.02.001.

Rittle-Johnson B, Schneider M. 2015. Developing conceptual and procedural knowledge of mathematics. In: Kadosh RC, Dowker A, editors. Oxford handbook of numerical cognition. Oxford: Oxford University Press; p. 1118–1134.

Salmon G, Ross B, Pechenkina E, Chase AM. 2015. The space for social media in structured online learning. Res in Learn Technol. 23(1):28507. doi: 10.3402/rlt.v23.28507.

Scagnoli NI, McKinney A, Moore-Reynen J. 2015. Video Lectures in eLearning. In: Nafukho FM, Irby BJ, editors. Handbook of research on innovative technology integration in higher education. PA: IGI Global; p. 115–134.

Siddiqui ZS, Fisher MB, Slade C, Downer T, Kirby MM, McAllister L, Isbel ST, Wilson CB. 2023. Twelve tips for introducing E-Portfolios in health professions education. Med Teach. 45(2):139−144. doi: 10.1080/0142159X.2022.2053085.

Suhail NA, Lubega J, Maiga G. 2013. Identification and performance analysis of multimedia to enhance blended learning experience in constrained bandwidth environment. MT. 2(3):25–32.

Swan RH, Plummer KJ, West RE. 2020. Toward functional expertise through formal education: identifying an opportunity for higher education. Education Tech Research Dev. 68(5):2551–2568. doi: 10.1007/s11423-020-09778-1.

Tahir R, Wang AI. 2020. Codifying game-based learning: development and application of LEAGUÊ framework for learning games. Electron J e-Learn. 18(1):69–87.

Tanner CA. 2006. Thinking like a nurse: a research-based model of clinical judgement in nursing. J of Nurs Educ. 45(6):204–211.

Vallely KSA, Gibson P. 2018. Effectively engaging students on their devices with the use of Mentimeter. Compass. 11(2):1–7. doi: 10.21100/compass.v11i2.843.

Wilson P, Long I. 2018. The Big Book of Blob Trees. NY: Routledge.

Witter S, Sheikh K, Schleiff M. 2022. Learning health systems in low-income and middle-income countries: exploring evidence and expert insights. BMJ Glob Health. 7(Suppl 7):e008115. doi: 10.1136/bmjgh-2021-008115.

Yang M, Tai M, Lim CP. 2016. The role of e-portfolios in supportive productive learning. Brit J Educational Tech. 47(6):1276–1286. doi: 10.1111/bjet.12316.

Yangoz ST, Okten C, Zeynep O. 2017. The use of e-learning program in nursing education. PROSOC. 4(2):230–236. doi: 10.18844/prosoc.v4i2.2752.

Zhang Y, Ghandour A, Shestak V. 2020. Using learning analytics to predict students performance in Moodle LMS. Int. J. Emerg. Technol. Learn. 15(20):102–115. doi: 10.3991/ijet.v15i20.15915.