**Harnessing Technology Affordances for Learner-centred Experiences in a MOOC**

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## Abstract

The past decade has seen more learning institutions adopt MOOCs towards improved course delivery, student engagement, and access to education. Facilitation remains a critical factor in the success of online learning as learners in disparate locations and with varying technology infrastructure need to be supported to achieve both their individual and collaborative goals in a MOOC. This paper reports on an innovative approach in the co-creation and facilitation of two cybersecurity MOOCs supported by the Commonwealth of Learning. We report on the utilisation of the MOOC platform and video conferencing technologies for support and engagement with participants. Besides the in-built learning analytics tools on the platform, we discuss other technologies that were integrated for more efficient data collection and qualitative analysis of feedback from participants. To ensure that participants could access and implement the security solutions covered in the course, we present ways in which they harnessed native capabilities within their existing operating systems (OS) to complete learning tasks. Finally, the use of free and open-source software is explored for various use cases such as data recovery, secure communication, and emerging technologies. The paper provides an innovative approach to incorporating technology affordances for learner-centred experiences in a MOOC.

**Keywords:** MOOCs, Facilitation, Innovative technology, Educational technology

## 1. Introduction

With increasing focus on open, online, and distance learning, Massive Open Online Courses (MOOCs) are uniquely positioned to extend access to education beyond physical classrooms and geographical boundaries through the provision of quality learning resources, free of charge via the internet. MOOCs allow learners across the globe to regulate and direct their own learning while being supported by course facilitators. The flexible learning opportunity attracts a vast and diverse audience with enrollments running into the thousands. When designing and delivering MOOCs, educators must take into account the large enrolment numbers that result in varied learner needs and expectations.

Effective and timely learner-instructor interaction is a critical factor in MOOC evaluation and success. A study by the University of Florida intimated that a timely response by the instructor plays an important role in online student satisfaction alongside engaged learning and control over the learning environment (Dziuban et al., 2015). Further, Kuo et al. (2013) determined that learner-instructor interaction and learner-content interaction coupled with technology efficacy are valid indicators of student satisfaction and positive perception of online courses. While the higher learner to instructor ratio experienced in MOOCs impedes facilitators in ensuring a positive student experience, it also provides an opportunity for educators to leverage affordances of scale and diversity in existing and emerging technologies.

This paper reports on the positive impact of technology in course design, delivery, facilitation and feedback generation during two MOOC courses. The courses reported on - Cybersecurity Training for Teachers (CTT) and Advanced Cybersecurity for Teachers (ACTT) - were sponsored by the Commonwealth of Learning. The courses were created out of the need to equip teachers and teacher educators with cybersecurity skills in response to the rise in cyber incidents in learning institutions during the Covid-19 pandemic. The success of the courses could largely be attributed to the innovative utilisation of technology affordances, leading to an average of 28% completion rate compared to a 10-20% global average (Hew & Cheung, 2014). In the paper, we focus on the technological considerations in course design, facilitation and feedback generation and sharing, to impact learner satisfaction, engagement, support, and overall course completion rates.

## 2. Literature on Technological Considerations for MOOCs

Although there are numerous studies focused on MOOCs as a modern teaching and learning technology, few have systematically reviewed innovative approaches in the co-creation and facilitation of MOOCs. According to Vieluf et al., the concept of innovative approaches in the co-creation and facilitation of MOOCs refers to current, context-dependent progress in educational practices and methods, and nonconformity of existing methods (Vieluf et al., 2012). The massive nature of MOOC platforms allows thousands of participants from different demographics to enrol and participate in a course. This was evidenced during the CTT and ACTT course offers. Additionally, MOOCs can be openly accessed online by participants from diverse regions without having met any pre-requisite of demographics or knowledge (Wicaksono, 2021). The non-traditional learning that takes place on MOOCs is a useful form of online learning.

The main classification of MOOCs co-creation and facilitation is Connectivist Massive Open Online Course (cMOOC) and Xtended Massive Open Online Course (xMOOC) (Pili, 2016). The learning approach in cMOOC is different from xMOOC. cMOOCs emphasise networking through content sharing among the participants. xMOOCs mainly use a learning model that focuses on the high-quality content transmission and delivery, computer marked assessment, peer assessment, supporting materials, a shared comment/discussion space, very light or no discussion moderation, badges or certificates, learning analytics, and computerization of all key communications between participants and the learning platforms (Fidalgo-Blanco et al., 2016). All CTT and ACTT offers utilised xMOOC technology.

Lack of innovative approaches in co-creation and facilitation of MOOCs has been raised by some critics, who observe that current MOOCs emphasise a passive and fixed approach to content creation and learner facilitation (Morris, 2013; Bates, 2014). This signifies a strong inclination towards content transmission, hardly on innovative practices of using MOOCs to create content and facilitate learning. This study is, therefore, a timely response that outlines ways in which MOOCs can be used innovatively to create content and facilitate learning, based on the experience that was gained in the CTT and ACTT MOOC offers.

## 3. Course Design

### 3.1. MOOC Implementation

The CTT and ACTT MOOCs were delivered through the Moodle and MooKIT platforms. The MOOCs utilised video lectures, articles, case studies, webinars as well as discussions to deliver content. Participants were expected to dedicate 4 to 6 hours to cover the week's content and carry out the indicated online activities, such as participation in discussion forums, quizzes, polls, and practical activities. The understanding of the topics covered per week was assessed through one or more practical activities, discussion forums, system-graded quizzes, and a final module assessment. These could be completed by the participant at any time and place convenient to them, within the prescribed time set for the topic.

The practical activities equipped the participants with hands-on skills through guided walkthroughs. Through a discussion forum dedicated to each activity, the participants would share their experience, success, or any challenges they faced. Through peer interaction and guidance by the course instructors, any participant facing challenges would be directed towards the correct outcome. Forums were utilised in various ways to engage participants. Email correspondence over the official course email was also useful in responding to users' concerns as well as making general announcements.

According to Littlejohn et al., (2016), the integration of real-world examples has been shown to increase learners' engagement in course tasks. Therefore, we introduced participants to industry experts who complemented the course content with real-life expertise and knowledge through weekly webinars. The webinar had a panellist session where any doubts and questions from the learners were clarified by the course instructors as well as the industry expert. The webinars were scheduled at a time that was convenient for a majority of the participants. A recording was shared with the participants who were unable to attend.

### 3.2. Course Co-Creation

Skill-based learning comprises theory, that presents the domain ideas, and practical exercises, where skills are imparted. Practical activities benefit distance and online learning by engaging students to enhance retention of theoretical knowledge covered in the course. In fact, learners have been perceived to take more interest in course tasks based on the provision for practical learning and incorporation of real-world examples (Littlejohn et al., 2016). The CTT/ACTT courses thus relied on practical activities to develop aptitudes in cybersecurity controls. The incorporation of hands-on tasks often requires specific hardware and software that may not be accessible to course participants. This, however, should not deter MOOC creators from including practical activities since various technical considerations can be accounted for to accommodate diverse hardware devices and software environments. In the CTT/ACTT courses, pre-course surveys uncovered insights on common device types, operating systems, and network connectivity options available to inform the practical activities included in the course content.

We explored the technology affordances provided by the devices that were already owned or available to the participants. This limited the need to download and install additional software to complete course tasks. Native capabilities found in existing operating systems such as Windows and Linux were harnessed to implement security controls. For instance, participants were instructed on the use of inbuilt antivirus, firewall, and encryption tools to protect against malicious software, block and allow various sites, and for data security respectively. Mobile device alternatives were also provided since about half of all course participants utilised smartphones and tablets for learning.

Tasks that required installation of additional tools necessitated research and comparison of similar software to select lightweight, open-source, cross-platform, easy to use and accessible tools. Lightweight tools are designed to utilise minimal system resources, thus participants with less powerful devices could comfortably complete course tasks. Affordability is one of the main MOOC advantages, hence the use of open-source tools that freely grant users rights to study and use software for any purpose was crucial for the CTT/ACTT courses. When open-source tools were unavailable, applications with freemium licensing options were considered. Freemium provides limited functionality for the free version, with access to full capabilities requiring a premium subscription. This option allowed participants to utilise tools without financial implications. All the resources needed to be cross-platform, to ensure availability for various operating systems and software environments, hence catering to more participants with varied resources.

All tools and technologies incorporated into the two courses required user guides to direct participants on how to install, interact and utilise the tools for the course tasks and activities. Participants who interacted with some tools for the first time through the CTT/ACTT courses recounted that the user guides made it considerably easier to learn and use tools. To avoid effort duplication, where feasible, course creators utilised official documentation as walkthroughs for some of the tools such as VeraCrypt for encryption and ProtonVPN for secure communication. Where the official documentation was complex, instructors created custom user guides to simplify and enhance the participant experience. The courses attracted participants from varied educational backgrounds, from high school to doctorate, hence, making the course as introductory and relevant as possible was key for the course creators. As evidenced, we utilised data collected from participants to tailor the course content and practical activities to available resources, ensuring that the CTT/ACTT MOOCs were accessible, inclusive, and relevant to the audience.

### 3.3. MOOC Delivery

The MOOC platform was an important aspect of the MOOC deployment. Moodle and MooKIT were used to develop and deploy the courses. CTT offers were entirely hosted on MooKIT, whereas ACTT's first offer was deployed on MooKIT and the second on Moodle. The Moodle platform provides a repository for both courses which can be available to individual partners upon request. The MOOC platforms' capabilities were explored during the course design phase for course management. This section focuses on examining the MOOC platform technological affordances that were critical to the successful operation of a MOOC. This section focuses on the MOOC platforms chosen, Moodle and MooKIT, and offers a feature list of their capabilities and how they contributed to the MOOCs' success.

### 3.3.1. Open-Source

Moodle and MooKIT are both open-source learning management platforms which means that their source code is free to download, install, host, modify and customise. MooKIT is an open-source MOOC Management platform designed and developed at IIT Kanpur. Learn Moodle, a MOOC Platform upgraded from the LMS, is utilised by millions of users worldwide. Their open-source nature came in handy in the second offer of ACTT, where adjustments were made to improve facilitation and learning experience. Moodle's ability to integrate plugins, themes, and other code-level modifications was essential in course customization.

### 3.3.2. Collaborative Functionalities

Collaborative learning has been used in MOOCs to help students build online learning communities and connect students together to promote peer learning. Learners in a course assist one another and enrich the course through discussions and interactions to encourage knowledge building (Titova, 2017; Imran et al., 2016). Collaboration also allows the learner to interact with the facilitators. Various tools, like discussion forums, video conferencing, and messaging, are used to integrate collaborative functionalities into MOOC platforms. Discussion forums were the key collaborative tools used in the training.

Discussion forums were used in three ways:

- General Forum: Technical Support and Gremlins - This was used by learners to inform the course facilitators and administrative team of challenges, errors or access control restrictions that they may have experienced.
- General Forum: Getting to Know You - This was used by learners to introduce themselves and let the course facilitators of their learning expectations. It provided an opportunity for peer engagement for the purpose of creating learning communities and networks.
- Activity Forums - These were used by course instructors to gauge the understanding of the course content. Engagement in these forums was mandatory as it was part of the grading system.

Discussions generated by the instructors were pinned for clear distinction from participant-created topics. The nested response feature in Moodle proved useful as it helped both the instructors and participants to organise, follow and contribute to discussions more effectively. MooKIT lacked this feature and engaging with a participant on their comment was limited to ‘liking’. Consequently, participants engaged with each other by creating their own forums which made it difficult to manage and follow discussions.

Another collaborative feature that was widely utilised in both CTT and ACCT was Announcements. The instructors set up Announcements for communicating with the learners. The major consideration made was whether the MOOC platform was able to simultaneously share the announcement through email to all participants. This option was optional in MooKIT while it was a default option in Moodle.

### 3.3.3. Considerations on Accessibility, Usability and Inclusivity

From ACTT Pre-Course survey results, most of the participants accessed the course using laptops and smartphones as shown in Table 1. This information was useful as the course design had to factor how content would be rendered on smaller screens. Both Moodle and MooKIT are designed to work on a computer, a smartphone, or a tablet.

| **Device** | **ACTT1** | **ACTT2** |
|---|---|---|
| Smartphone | 69.11% | 67.15% |
| Laptop | 70.43% | 74.09% |
| Desktop Computer | 21.03% | 28.10% |
| Tablet | 12.50% | 15.69% |
| Other | 0.72% | 0.73% |

*Table 1: Devices Used to Access ACTT1 and ACTT2*

Participants on both platforms found platform navigation to be challenging. Accessing learning materials, as well as forums, exams, quizzes, polls, and surveys, proved difficult in certain cases. As there was no explicit download feature provided, many participants were unable to download the videos. The need for an introductory webinar session across all offers was identified, during which participants were taken through the course on both a computer and a phone.

In all the offerings, internet connectivity was the main challenge faced by participants. The connection was either expensive, slow or unstable. As a result, access to content, webinars, and, in some instances, course completion were all impeded. From the End-of-Course surveys, many participants requested for the course to be made offline. Innovations on MooKIT (Vadlamani, Revathy & Prabhakar, 2019) are able to adapt to low bandwidth in Semi-Online MooKIT or even offer fully offline course delivery by bundling archived courses in a mobile app which enables all course content to be accessed locally, thus giving a complete MOOC experience without internet connection. MooKIT's capacity to choose the delivery mode from video (when high) or audio (when modest) dependent on available bandwidth is also useful to participants with internet access challenges.

#### 3.3.4. Platform Modularity and Customization

Moodle's modular design allows it to be tweaked and suited to specific needs. During ACTT2, Moodle's theme was customised to reflect Commonwealth of Learning's branding. The instructional designer created interactive books using HP5, which broke the monotony of long-form prose. Moodle and MooKIT both support embedding videos from YouTube. The variety of free and publicly available plugins, add-ons, and themes that can be integrated to achieve specific functionalities contributes to Moodle's popularity.

## 4. Course Facilitation

In order to achieve active engagement between participants and facilitators, a number of platforms were selected based on ease to use, security and convenience. Support was provided to learners through the selected platforms to address any issues faced such as platform navigation and technical difficulties. Being cognizant that participants had varied ICT skills, facilitators were available to actively respond to any queries, working 35 hours a week. Participants were supported through:

### 4.1. Zoom Video Conferencing Platform

Zoom was the preferred choice for holding weekly webinars due to its functional features, familiarity, security options and ease of use. Most learning institutions utilised Zoom during the pandemic, hence the participants were already conversant with it. The platform's unique inbuilt time conversion feature allowed participants to convert the scheduled weekly webinars to their local time, to prevent time zone confusion. Each webinar included a Questions & Answer session to answer participants' questions submitted through email and Google Forms. The Zoom inbuilt Q&A feature simplified the moderation of live queries as course facilitators were able to effortlessly mark a question resolved after it was answered.

To ensure only authorised persons could attend, participants had to register for the webinar to receive a closed invitation unique to them. The Waiting Room feature allowed the host to admit participants joining the meeting. Participants were muted upon entry to prevent unnecessary disruption. Lastly, participants used the raise hand feature and the comment section to raise concerns. For uniformity and visibility, instructors and guest speakers employed the Commonwealth of Learning customised background. Though it was not implemented in the CTT/ACTT courses, breakout rooms in Zoom can be utilised for active peer-to-peer interactions.

### 4.2. Email Correspondence

A dedicated mail hosted on IONOS webmail was used to answer enquiries and address any issues or challenges encountered while learning such as account reset, missing content, access to webinar links, and access to presentation slides. The email was active throughout the course period allowing participants to reach out to the instructors at any time of the day. When challenges on Moodle and MooKIT were beyond the facilitator's expertise, issues were escalated to technical support engineers via email.

### 4.3. Segregated Support

Segregated support was implemented to provide participants with multiple channels of assistance. The technical support forum was used for learners to post technical challenges within the course. Participants were encouraged to upload a screenshot for ease of comprehension of the issue. Challenges pertaining to the weekly practical activities were posted on the specific activity forum.

## 5. Course Feedback

### 5.1. Data Collection

Meaningful feedback and course reviews are used to assess a MOOC's impact and identify areas for adjustments and improvement. During the four MOOC offerings, data was collected through surveys hosted on LimeSurvey, an open-source, online survey tool. The Pre-Course, End-of-Course, and "Tell Us Your Story" surveys were conducted in each course offer. The responses as shown in Table 2, gathered important demographic information as well as data regarding the course, with a focus on the course material, delivery methods, challenges, and improvements, as well as course relevance and impact. The significant decrease in numbers in ACTT2 was mainly due to the transition from MooKIT to Moodle as the MOOC delivery platform. Learners were used to accessing the course on MooKIT and were not aware of the shift to Moodle.

The surveys were designed as questionnaires with open-ended and closed-ended questions, allowing participants to contribute valuable input without prejudice while also limiting responses to the available options when necessary. The inbuilt survey/poll capability within the MOOC platforms was used to conduct polls and collect feedback from the participants regarding specific course topics.

| | **CTT 1** | **CTT 2** | **ACTT 1** | **ACTT 2** |
|---|---|---|---|---|
| Pre-Course Survey | 528 | 596 | 832 | 274 |
| End-of-Course Survey | 403 | 398 | 441 | 126 |
| Tell Us Your Story | 80 | 57 | 79 | 12 |

*Table 2: Survey Responses across all offerings of CTT and ACTT*

### 5.2. Data Analysis

Both qualitative and quantitative studies were used to analyse the information gathered. Thematic analysis was used to analyse and report on themes in the qualitative data and to interpret findings. An in-depth analysis of feedback data from both MOOCs' first offerings was especially helpful in improving the overall quality of the subsequent offers. Participant's performance, demographics, and attendance were analysed using inbuilt MOOC analytics tools. Furthermore, NVivo, a data analysis tool, was used to analyse deeper data from sources like the email, Zoom and the MOOC chat application to generate reports. NVivo can virtually import data from any source, analyse data with advanced management, query, and visualisation tools and achieve robust research results within a short period.

## 6. Impact of Harnessing Technology

Participants, through the "Tell Us Your Story" survey, conveyed the impact of the technologies learned through the CTT/ACTT courses. They conveyed that the MOOC platform (Moodle) was user-friendly, easy to navigate with a well-structured course. The videos and webinars were excellent. Some of the stated outstanding aspects are provided below:

*"The course was so motivating according to the different style of learning in the MOOC, like use of guest speakers, case study, video watching, use of infographics and so on."*

*"The use of Technology had a great impact in the course. I was able to apply the knowledge learned about best practices in cybersecurity, using VPNs, managing cookies, and blocking websites as I utilised learning platforms personally and the LMS with my students."*

Participants were ready to sensitise their institutions, learners, and the community using various means as explored in the course content. As was noted in the "Teacher Stories", the majority would conduct awareness campaigns through meetings, online learning platforms and during classroom lessons. At the end of the ACTT course, some had already started enlightening their students, colleagues and family. Sample feedback is provided below:

*"I have actually started teaching this course to my students because it coincides with one of the topics I am required to teach, that is 'threats to computers and its users'. In fact, this course provided me with the resources needed for the lessons."*

*"The Advanced Cybersecurity Training for Teachers propelled me to utilise my personal blog as a hub to transfer the plethora of knowledge and skills that were garnered during both sittings of the course (CTT & ACTT) with my colleagues, parents, and student body. I am looking forward to hosting a professional development workshop with my staff in the near future on Cybersecurity as well."*

## 7. Conclusion and Recommendation

Based on the analysis of the technology incorporated in the four offerings of the CTT/ACTT courses, we established that technology can be leveraged in multiple ways to aid course creators and facilitators in effectively hosting MOOCs for disparate audiences. Technological considerations such as available hardware and software resources, accessibility (open-source, cross-platform), inclusivity and ease of use made in MOOC design, delivery and support ensured learner satisfaction and engagement. Utilisation of third-party tools discussed was instrumental in feedback sharing, data analysis, and participant engagement. While social media and messaging platforms were not used, we recommend their exploration, especially for smaller numbers of MOOC participants to promote faster responses from instructors and encourage more peer networking. MOOC creators and facilitators should collect data about their target audience to determine the available technological infrastructure and inform the affordances that can be harnessed to perform course tasks.

Based on the impact assessment from feedback shared by participants, we conclude that integration of technology affordances in course design, delivery and support is instrumental in ensuring learner-centred experiences in the MOOCs.

**References**


Bate, T. (2015, April 5). 5.4 strengths and weaknesses of MOOCs – Teaching in a digital age. BCcampus Open Textbooks – Open Textbooks Adapted and Created by BC Faculty. https://opentextbc.ca/teachinginadigitalage/chapter/section-7-5-strengths-and-weaknesses-of-moocs/

Bates, T. (2014, October 13). Comparing xMOOCs and cMOOCs: Philosophy and practice. Online Learning and Distance Education Resources. https://www.tonybates.ca/2014/10/13/comparing-xmoocs-and-cmoocs-philosophy-and-practice/

Digital tools for seamless learning. (2017). Advances in Educational Technologies and Instructional Design. https://doi.org/10.4018/978-1-5225-1692-7

Dziuban, C., Moskal, P., Thompson, J., Kramer, L., DeCantis, G., & Hermsdorfer, A. (2015). Student Satisfaction with Online Learning: Is It a Psychological Contract? Online Learning, 19(2), n2.

E-learning methodologies and good practices. (2010). https://doi.org/10.4060/i2516e

Fidalgo-Blanco, Á., Sein-Echaluce, M. L., & García-Peñalvo, F. J. (2016). From massive access to cooperation: Lessons learned and proven results of a hybrid xMOOC/cMOOC pedagogical approach to MOOCs. International Journal of Educational Technology in Higher Education, 13(1). https://doi.org/10.1186/s41239-016-0024-z

Freidus, H. (2015). Constructivists Online: Reimagining Progressive Practice. ERIC - Education Resources Information Center. https://files.eric.ed.gov/fulltext/ED573406.pdf

Haron, H., Hussin, S., Mohd Yusof, A. R., & Yusof, H. (2019). Mooc initiative: A technology enhanced learning in 21 century at higher learning institutions. Journal of Information System and Technology Management, 4(14), 26-33. https://doi.org/10.35631/jistm.414003

Helling, K., & Petter, C. (n.d.). Collaborative knowledge construction in virtual learning environments. Virtual Learning Environments, 1039-1059. https://doi.org/10.4018/978-1-4666-0011-9.ch510

Hew, K. F., & Cheung, W. S. (2014). Students' and instructors' use of massive open online courses (MOOCs): Motivations and challenges. Educational research review, 12, 45-58.

Imran, A. S., Pireva, K., Dalipi, F., & Kastrati, Z. (2016). An analysis of social collaboration and networking tools in eLearning. Lecture Notes in Computer Science, 332-343. https://doi.org/10.1007/978-3-319-39483-1_31

Kuo, Y. C., Walker, A. E., Belland, B. R., & Schroder, K. E. (2013). A predictive study of student satisfaction in online education programs. The International Review of Research in Open and Distance Learning, 14(1), 16-39.

Littlejohn, A., Hood, N., Milligan, C., & Mustain, P. (2016) Learning in MOOCs: motivations and self-regulated learning The Internet and Higher Education 29, 40-48

Mariana, P., & Venkataraman, B. (2016). Making sense of MOOCS: a guide for policy makers in developing countries. https://unesdoc.unesco.org. https://unesdoc.unesco.org/ark:/48223/pf0000245122

Morris, L. V. (2013). MOOCs, emerging technologies, and quality. Innovative Higher Education, 38(4), 251-252. https://doi.org/10.1007/s10755-013-9263-2

Palloff, R. M., & Pratt, K. (2003). The virtual student: A profile and guide to working with online learners. John Wiley & Sons.

Pili, O. (2016). A Taxonomy of Massive Open Online Courses. Contemporary Educational Technology. https://www.cedtech.net/download/a-taxonomy-of-massive-open-online-courses-6174.pdf

Prabhakar, Balaji & Revathy (2018). MooKIT - A MOOC Platform for Developing Countries. Retrieved from http://oasis.col.org/handle/11599/3047

Qualitative data analysis software | NVivo. (n.d.). Technology & Software Solutions | QSR International. https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/home

Rohini, & Chhabra, I. (2014). Quality analytics for evaluation of dynamic web-based learning environments. 2014 IEEE International Conference on MOOC, Innovation and Technology in Education (MITE). https://doi.org/10.1109/mite.2014.7020257

Shah, D., Pickard, L., & Ma, R. (2022, January 11). Massive list of MOOC platforms around the world in 2022 — Class central. The Report by Class Central. https://www.classcentral.com/report/mooc-platforms/

Stracke, C. M., & Trisolini, G. (2021). A systematic literature review on the quality of MOOCs. Sustainability, 13(11), 5817. https://doi.org/10.3390/su13115817

Titova, S. (2017). The use of MOOC as a means of creating a collaborative learning environment in a blended CLIL course. CALL in a climate of change: adapting to turbulent global conditions – short papers from EUROCALL 2017, 306-311. https://doi.org/10.14705/rpnet.2017.eurocall2017.731

Vadlamani, Revathy & Prabhakar, (2019). Innovations In MOOC Platforms for Improved User Experience. Retrieved from http://oasis.col.org/handle/11599/3342

Vieluf, S., Kaplan, D., Klieme, E., & Bayer, S. (2012). Teaching practices and pedagogical innovations. TALIS. https://doi.org/10.1787/9789264123540-en

Wicaksono, H. (2021). Online learning in Digital Era: Opportunities and challenges. https://doi.org/10.31219/osf.io/sa62p