

## ORIGINAL RESEARCH ARTICLE

### Exploring the characteristics of adults' online learning activities: a case study of EdX online institute

Yuewei Shi<sup>a\*</sup> and Xi Lin<sup>b</sup>

<sup>a</sup>College of Education, Department of Educational Foundations, Leadership and Technology, Auburn University, Auburn, AL, USA; <sup>b</sup>College of Education, Department of Interdisciplinary Professions, East Carolina University, Greenville, NC, USA

(Received: 29 January 2021; Accepted: 08 May 2021; Published: 03 August 2021)

Online learning has become a prevailing trend among adult learners. Therefore, this study investigated the learning time preference and the relationship between the course completion and learning activities among adult learners based on data from one online learning platform. Results indicate that a periodical fluctuation of participating online course study exists among adult learners. Additionally, the activity of posting on the discussion board is a main learning activity factor that influences their online course completion. It is expected that this study would help online learning system designers, education administrators and instructors to better understand the characteristics of adult learners and their learning activities to provide better accessibility and flexibility in online learning environments for them.

**Keywords:** EdX platform; adult learners; online learning; learning activities; online instruction

#### Introduction

With the advancement of telecommunication technology, online learning has become a popular learning approach among adult learners. The first Massive Open Online Courses (MOOC) were carried out by George Siemens and Stephen Downes on 'Connectivism and Connected Knowledge' in 2008 (Shrivastava 2018, p. 4). During the past 10 years, adult learners have gradually adopted MOOC as one important distance learning platform. According to Hollands and Tirthali's (2014) statement, each word of MOOC represents the mission, goals and value of this platform. To be specific, 'Massive' represents a large number of participants and unlimited capacity for courses, participant activity and performance data (Hollands and Tirthali 2014). 'Open' refers to 'free access to individual courses, and sometimes it also applies to open or open content platform' (Blagojević and Milošević 2015, p. 346). 'Online' means MOOC is delivered through the internet (Hollands and Tirthali 2014), and 'Course' indicates 'organizing content in a given time interval, from a subject area, which contains a set of resources with clearly defined goals and outcomes'

---

\*Corresponding author. Email: yzs0062@auburn.edu

(Blagojević and Milošević 2015, p. 346). According to the descriptions, MOOC overcomes the time, space and economic challenges that adult learners encounter when learning online.

The Class Central's data (Shah 2016) reported that more than 1800 free online courses were launched in 2016 by various MOOC providers. Additionally, the most popular MOOC platforms such as COURSEA, IVERSITY and EDX have attracted millions of users, and this number has continually increased (Freire, del Blanco, and Fernández-Manjón 2014; Ruiz *et al.* 2014) because 'MOOCs unique potential lies in the fact that they have discovered that there are millions of people of all ages around the world eager to learn' (Sanchez-Gordon and Luján-Mora 2013, p. 1). Meanwhile, courses that are provided in MOOC cover different subjects ranging from science to social science (Jaramillo-Morillo *et al.* 2017). Therefore, online learners are able to access different courses depending on their academic or career needs. Moreover, MOOC has cooperated with higher education institutions, and many first-tier universities have become MOOC's main online course providers (Gaebel 2013). For example, EdX was jointly launched by MIT and Harvard University in 2012, and it later became one large and popular MOOC learning platform (Freire, del Blanco, and Fernández-Manjón 2014). Furthermore, EdX not only provides the opportunity for users to register and audit the course but also certifies the achievement of online learners after they pass the course (Ch and Popuri 2013).

Instructors are the course providers in an online learning platform, while online learners are the main receivers and participants in online courses (Wang *et al.* 2009). However, in contrast to the traditional students learning online, adult online learners often have different learning behaviors that are influenced by their time management, as well as active participation and practice toward their online learning success (Roper 2007). It is assumed that adult learners have their unique learning characteristics in an online environment. Therefore, it is necessary for online educators to understand the online learning activities of this learner group, to better help their learning. As a result, this study explores the adult learning activities using EdX as the platform through the following questions:

1. What is the time preference for participating online learning among adult online learners?
2. What is the relationship between the certificate completion and the main online learning activity preference on EdX online learning platform?

## Literature review

### *EdX platform*

EdX platform provides various teaching and learning functions for online learning, such as lecture videos, etexts, online office hours and assignments, which utilise normal writing homework, laboratories and exams (Pardos *et al.* 2013; Ruiz *et al.* 2014). Moreover, EdX online learning platform has four basic characteristics (Ch and Popuri 2013): (1) courses are accessible to learn for free; (2) vast number of courses from top universities will satisfy the different needs of online learners; (3) they can certify the course completion achievement of online learners and (4) courses are available to learn anytime and anywhere through the internet.

In order to facilitate different online teaching activities, instructors are able to collaborate with online learners through Wiki and virtual lab in EdX, and its discussion forum also provides space for both instructors and learners to communicate with each other. (Sanchez-Gordon and Luján-Mora 2013). Through providing the various communication tools, EdX strives to establish a platform that encourages teaching and learning interaction between the instructors and the online learners. Additionally, adult learning is usually a practice-oriented process that encompasses theory and practice during teaching and learning (Merriam and Bierema 2013). Thus, EdX aims to provide the feasibility of linking teaching and learning practice in an online environment. For example, Parry (2012) described one online MIT course, in which students learned the course through EdX at home and apprenticing skills at school. The results indicated that the majority of students participating online learning earned the completion certificate through this activity. Sanchez-Gordon and Luján-Mora (2016), therefore, highlighted that the future of MOOC design should meet the accessibility demanded by different adult learners and construct an inclusive environment.

### ***Adult online learners***

The National Center for Education Statistics (NCES) (2001, p. 1) defined distance education as ‘education or training courses delivered to remote (off-campus) locations via audio, video, or computer technologies including both synchronous and asynchronous instruction’. According to the 2018 statistics of NCES, more than 5 million adult students have enrolled in postsecondary education institutions in the United States, and nearly 60% of all enrolled students have taken at least one online course (National Center for Education Statistics 2019). Thus, it seems that taking online courses has become a popular trend among both traditional and adult students.

Studies noted that the early distance education included correspondence or home study, and most of the early distance learners were adults with professional, social and family roles outside of the learning setting (Park and Choi 2009; Simonson *et al.* 1997). Compared to younger students enrolled in a traditional campus-based degree program, adult learners usually take courses part-time, and their learning persistence often associates with acquiring new knowledge and skills towards their professional growth (Stein and Glazer 2003; Waits and Lewis 2003). Gold (2005) further stated that adult learners have their own physical, social and cognitive characteristics towards learning, and they are identified as a unique learner group. Blackmore (1996) developed Knowles’ Andragogy theory and proposed five adult learning assumptions: (1) adults are goal oriented, (2) adults are relevancy oriented (problem centred), meaning that they need to know why they are learning something, (3) adults are practical and problem-solvers, (4) adults have accumulated life experiences and (5) adults are autonomous and self-directed. Therefore, with more adult learners taking online courses, the design concept of an online learning platform should take the learning characteristics of this learner population into consideration.

Additionally, adult learners often face three types of challenges in a traditional learning setting (Cross 1981): situational challenges (e.g. money, time and emotional support), dispositional challenges (e.g. lack of self-confidence or confidence in the institution’s willingness to respond to their needs) and institutional challenges (e.g. unavailability of class time and anti-adult student biases on the part of faculty and staff). Although learning online would overcome some of these challenges such as the

time and financial conflicts, some of the internal factors including social and academic integration, technology usability issues and a lack of motivation would lead to negative online learning among adult learners (Park 2007). Therefore, Dabbagh (2007) summarised four characteristics of a successful online adult learner: (1) be skillful in using online learning technologies, particularly interactive and collaborative tools, (2) has a strong academic self-concept and good interpersonal and communication skills, (3) owns a basic understanding and appreciation of collaborative learning and develops competencies in related skills and finally (4) acquires self-directed learning skills through the deployment of time management and cognitive learning strategies.

Accordingly, a strong online instructional design should improve distance teaching techniques as well as facilitating self-directed and practice-centred learning demands of adult online learners (Diaz 1999). Specifically, teaching techniques such as peer-moderated discussion, group projects and conferencing meetings should facilitate the development of self-directed learning and a sense of community among adult learners in online learning environments (Kauffman 2015).

### ***Online learning activities***

Online learning tends to create challenging activities that promote online learners to connect new information to old, acquires meaningful knowledge and utilises their metacognitive ability (Bonk and Reynolds 1997). Activities are often defined as ‘anything students are expected to do, beyond getting input through reading or listening, in order to learn, practice, apply, evaluate, or in any other way respond to curricular content’ (Brophy and Alleman 1991, p. 9). Herrington *et al.* (2004) further noted that conducting activities, investigations and problems are three main motivators of student engagement in meaningful education contexts. Therefore, the design of learning activities in online learning environments will influence the learning effectiveness and achievement of online learners.

Specifically, online learning activities can be divided into different categories according to different interactional types. For instance, Nguyen (2017) categorised online learning activities into three types: (1) student–teacher interactional type, (2) student–student interactional type and (3) student–content interactional type. For the student–teacher interactional type, online learning activities usually include open virtual classroom meetings integration. The student–student interactional type consists of discussion forum, chat, Wiki, workshop, group assessment, messages and blogs. Finally, the student–content interactional type comprises lessons, assignments, quizzes and surveys (Nguyen 2017). Simonds and Brock (2014) listed several main online teaching and learning activities such as conducting live chats; commenting on online discussion boards; exploring web links and online materials; watching videos or listen to audio contents; reading lecture notes, course texts and articles; communicating through emails or conferencing meetings; and participating in online small group projects. Cundell and Sheepy (2018) later on summarised the characteristics of online learning activities. They concluded that the primary online learning activities usually concentrate on discussing, course contents reading, video playing and quiz taking.

Although previous studies searched on online learning characteristics and the categories of online learning activities, limited study has explored neither the frequency of utilising an online learning platform nor the relationship between the course completion and online learning activities among adult online learners. Therefore, this study

investigates the frequency of using the online learning platform and the relationship between the online course completion and online learning activities of adult learners. Specifically, this study aims to examine (1) the time preference of participating online learning among adult online learners and (2) the relationship between the certificate completion and the main online learning activity preference on EdX online learning platform.

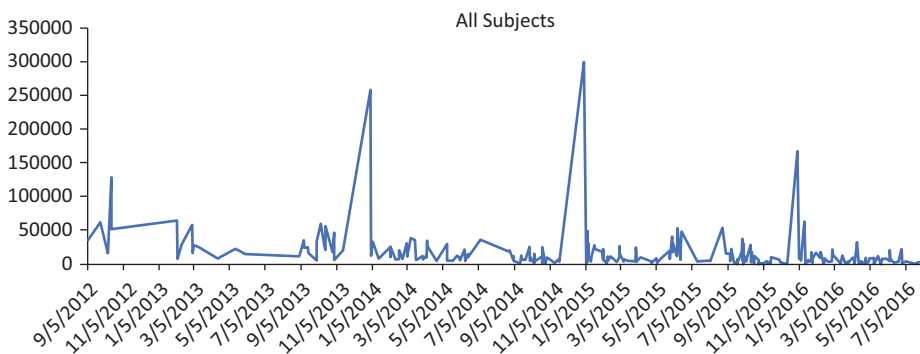
**Method**

Data were retrieved from the appendix links of HarvardX and MITx: Four Years of Open Online Courses – Fall 2012–Summer 2016 (Chuang and Ho 2016). This report provides general demographic information and online teaching and learning activities of online users in EdX platform. The statistical indicators include institution names, instructor names, launch dates, subjects, participation numbers, the percentage of earn certification, grading, course hours, learning activities and demographic information (i.e. age, gender and educational level). To be specific, 290 courses were offered by Harvard and MIT in the EdX platform. The course subjects covered STEM (Science, Technology, Engineering and Mathematics), CS (Computer Science), GHSS (Government, Health and Social Science) and HHRDE (Humanities, History, Religion, Design and Education). In order to examine the frequency of online learning participation of adult learners in EdX, the launch dates and participation number of all courses were reordered and counted it, and distributed on the horizontal axis and vertical axis of the line graphs across different subjects. A series of multiple regression using stepwise procedure was used to investigate the relationship between the certified percentage, the percentage of video playing and the percentage of forum posting across the different subjects.

**Results**

***RQ1 What is the time-frequency of participating in online learning among adult online learners?***

Description results show that most adult learners choose to register and attend online courses between November to January. In other words, the majority of adult online learners prefer to take online courses at the end of a year or at the beginning of a new year (see Line Graph 1).



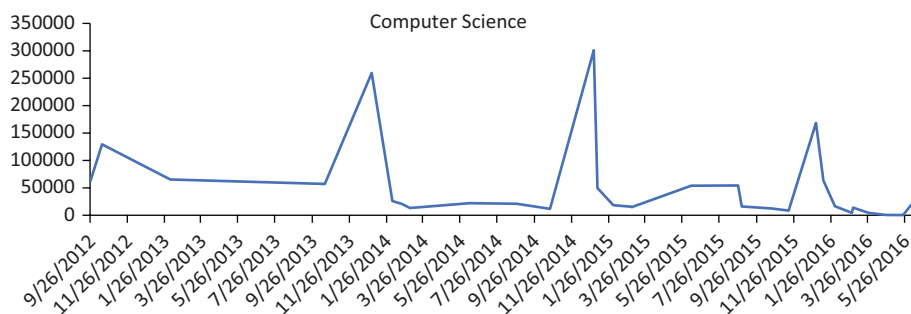
Line Graph 1. The participation number of all EdX courses for each month from 2012 to 2016.

However, the frequency of taking online courses is different between some subjects. For example, for CS courses, the curve of participation numbers concentrates from September to January of the next year. However, the fluctuation of the participation numbers of CS courses is similar to that of the trends of all subjects (see Line Graph 2).

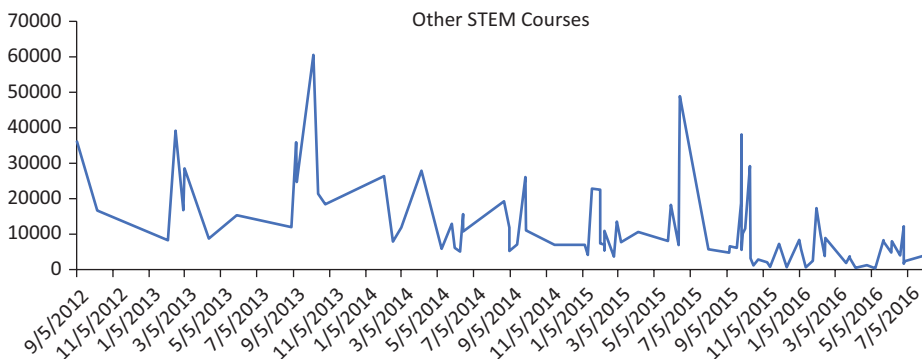
For other STEM courses, the increasing trend of students' participation is located in January to March, July to September and September to November. That is, the increasing and decreasing trends of participation numbers for STEM courses in EdX are similar to the normal course schedule or calendar of higher education institutions (see Line Graph 3). When looking at the wave of all subjects, the curve peak for students' participation in other STEM courses is different compared to the November to January periodical fluctuation of the curve of all subjects.

For GHSS courses, the curve crest appears on the following periods: February to April, April to June and August to October for each year. The periodical fluctuation of student participation numbers in these courses is different from the curve of the participation numbers of all subjects (see Line Graph 4).

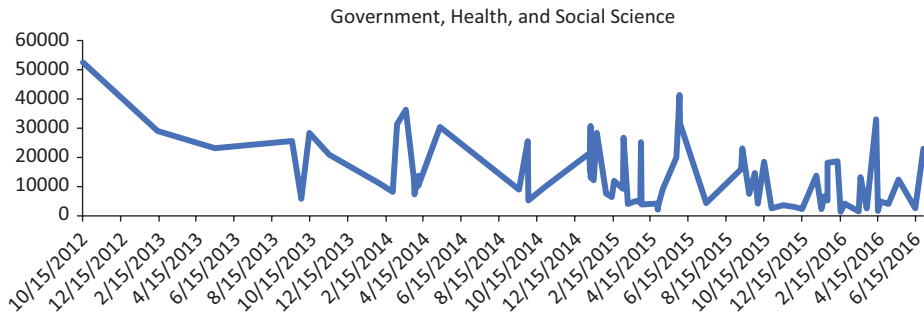
For HHRDE courses, most adult online learners prefer to enrol in these courses in two periods: September to November and March to May, which is different from the curve trend of all subjects' participation.



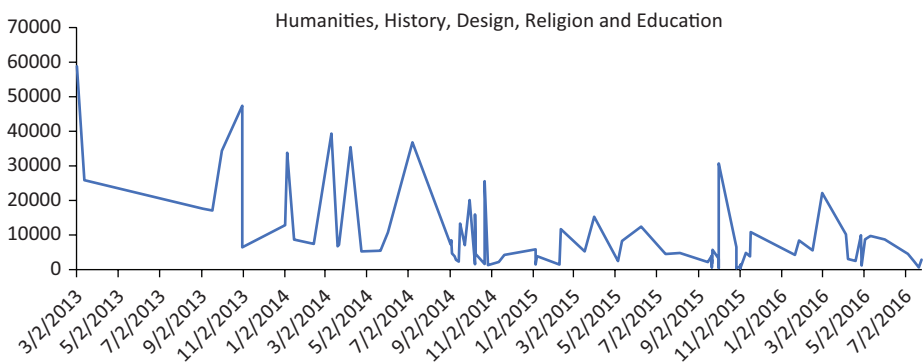
Line Graph 2. The participation number of EdX computer science courses for each month from 2012 to 2016.



Line Graph 3. The participation number of EdX STEM courses for each month from 2012 to 2016.



Line Graph 4. The participation number of EdX government, health and social science courses for each month from 2012 to 2016.



Line Graph 5. The participation number of EdX humanities, history, design, religion and education courses for each month from 2012 to 2016.

**RQ2. What is the relationship between the certificate completion and the main online learning activity preference on EdX online learning platform?**

Correlation results show that the relationship between certified percentage, video playing percentage and forum posting percentage is significantly correlated. Specifically, the percentages of video playing and forum posting have positively influenced the certified percentage. In other words, adult online learners who complete and receive course certifications usually do activities such as playing course videos and posting on the discussion board (see Table 1).

A series of multiple regressions using stepwise procedure were then conducted to investigate the predictable relationship among certified percentage, the percentage of video playing and the percentage of forum posting (see Table 2). Results indicate that the percentage of posting on forums can predict the certified percentage for each subject. For CS courses, the forum posting variable level can predict the certified percentage of these courses,  $F(2, 27) = 39.256, p < 0.001$ . The forum posting percentage level can be accounted for by 58.4% of the certified CS courses variance ( $R^2 = 0.584$ ). For every unit of the percentage of forum posting increases, the level of percentage of certified courses increases by 76.4 unit.



Table 1. Correlation among certified percentage, playing video percentage and post on forum percentage for all subjects.

Variables	1	2	3
	Coefficient		
Certified percentage	–	0.530	0.764
Videos playing		–	0.638
Forum posting			–

Table 2. Multiple regression results.

DV	R <sup>2</sup>	F	df	p	Predictors	b	t	p
Certified percentage (computer science)	0.584	39.256	2, 27	<0.001	Forum posting	0.764	6.265	<0.001
Certified percentage (other STEM)	0.415	63.213	1, 89	<0.001	Forum posting	0.644	7.591	<0.001
Certified percentage (government, health and social science)	0.114	9.367	1, 73	0.003	Forum posting	0.337	3.061	0.003
Certified percentage (humanities, history, design, religion and education)	0.054	5.205	1, 92	0.025	Forum posting	0.231	2.281	0.025

Similarly, in terms of the certified percentage of other STEM courses, results indicate that the forum posting percentage level can predict the certified percentage of other STEM courses,  $F(1, 89) = 63.213, p < 0.01$ . The level of the forum posting percentage can be accounted by 41.5% of variance of the certified percentage of other STEM courses ( $R^2 = 0.415$ ). For every unit of the forum posting percentage level increases, the percentage of certified courses for other STEM courses increases by 64.4 unit.

For GHSS courses, the level of the forum posting variable can predict the certified percentage of these courses,  $F(1, 73) = 9.367, p < 0.01$ . The level of the percentage of forum posting can be accounted for by 11.4% of the variance of the certified percentage of GHSS courses ( $R^2 = 0.114$ ). For every unit of the level of the percentage of forum posting increases, the level of the percentage of certified for GHSS course increases by 33.7 unit.

Finally, the regression results demonstrate that the level of the percentage of the forum posting can predict the certified percentage of HHRDE courses,  $F(1, 92) = 5.205, p < 0.01$ . The level of the percentage of forum posting can be accounted by 5.4% of the variance of the certified percentage of these courses ( $R^2 = 0.054$ ). For every unit of the level of the percentage of forum posting increases, the level of the percentage of certified courses for HHRDE courses increases by 23.1 unit.

## Discussions

According to the results, adult online learners prefer to take online courses between November to January for all subjects in EdX. The frequency of participating online



courses for CS and other STEM subjects approximately matches the time curve of participation numbers for all subjects. However, the time fluctuation curves of participating GHSS and HHRDE courses are different with the time curve of participation numbers of all subjects. From an academic institutional schedule perspective, the periodical fluctuation trends of the participation number of these two subjects match the regular academic calendar. Specifically, adult online learners prefer to take these social science courses during a normal academic fall or spring semesters. These results in some way support Ch and Popuri's (2013) statement that one feature of the EdX online platform is that online learners are able to choose and pick which course they want to take at any time in a year.

Although the EdX online learning platform provides the opportunities for all adult online learners to access online learning resources any time, the time preference of choosing to take online courses among adult learners is still relatively following the routine of the institutional academic calendar. The 4-1-4, which refers to 'a fall term which ends before the December holidays, a January term of approximately one month, and a spring term equivalent in length to the fall term' (Davis 1972, p. 145), is one of the most typical academic calendar schedules that applied into many higher education institutions. As the online courses in EdX platform are offered by Harvard and MIT, the launch dates of online courses are relatively consistent with the traditional college academic calendar. The research results support that the peak periods of enrolment in online courses among adult online learners are similar to the start date of the college term calendar. It is plausible to explain that the periodical fluctuation towards the participation number of online courses is influenced by the different launch dates of the EdX platform's courses. However, this phenomenon can also be explained as that adult online learners may have their own preference in terms of taking online courses due to the schedule conflicts impacted by their professional, social and family roles (Park and Choi 2009; Simonson *et al.* 1997).

Findings also revealed that playing videos and posting on forums are the two main online learning activities that positively associate with the course completion. However, only the learning activity of forum posting can predict the certified percentage of online courses across different subjects. Mitros and colleagues (2013) found that the online discussion forum usually offers a platform where students can ask questions and receive feedback, with 92% of the questions posed in the discussion have answers in a short time. Forums in an online learning platform aim to provide diverse types of online discussions, such as Q&A sections, debate discourse pattern (e.g. argument and defence) and self-reflection pattern (e.g. speech or comments) (Blagojević and Milošević 2015; Zhang, Culbertson, and Paritosh 2017). Therefore, posting on forums and discussions with the instructors and peers are main learning activities that students acquire knowledge and complete online courses. In other words, these findings indicate that a learning combination of these two activities would promote online course completion. Finally, scholars (Díaz *et al.* 2015) noted that students would withdraw from viewing videos as time goes by. Findings of this study echo with this statement that watching videos is not a predictable factor in the course completion.

## **Conclusion and implication**

In conclusion, this study explores the frequency of participating in online courses and the relationship between the course completion percentage and online learning activities on EdX among adult online learners. The results indicate that

these students have their own study time preference when taking online courses. Additionally, posting on forums is identified as one major online learning activity that associates with the course completion. Findings indicate that although online courses are available for access anytime, the launch dates for course certificates are limited to some specific periods of the year. Since most of online courses are provided by higher education institutions, the schedule of launching new courses and certified qualified learners remains consistent with the pattern of the institutional academic calendar. Cercone (2008) stated that many adult learners prefer to choose online learning because of the flexible schedule and the convenient learning format. Therefore, online course providers and administrators should consider providing more available course launch date options for adult online learners according to their unique time preference.

This study also shows that posting on forums while taking online courses closely relates to a course completion among adult online learners. Therefore, the online course instructors should consider integrating suitable strategies to encourage adult learners' learning motivations and help them succeed in online learning environments. Mazzolini and Maddison (2007) found that the participation rate, lengths of discussion threads and students' perceptions concerning their learning are usually influenced by the frequency of forum posting, the posting time and the nature of instructor's participation in an online discussion board. That is, online course instructors should increase the frequency of participating in the online discussion board, as well as approaching the right time to post. Along with that, instructors' online postings should concentrate on answering questions, initiating additional questions, following up questions and providing comments. In summation, the instructors should perform as mediators in order to motivate online discussion among adult online learners.

Additionally, in order to encourage an effective interaction between the course instructors and learners in an online discussion, the online learning platform designers should develop a practical and functional online learning platform to support a variety of educational activities in an online discussion board. Gao, Zhang and Franklin (2013) summarised four directions to facilitate the online discussion effectively: (1) supporting diversity learning goals, (2) integrating other techniques to deal with the issues in an online discussion board, (3) designing multifunctional feature in the online discussion environment and (4) developing appropriate instructional activities section for the online discussion environment. In some sense, these four directions can be used as the principles to guide the design of an online discussion board in order to satisfy the learning demands of adult online learners, as well as encouraging their learning motivations.

Several limitations exist in this study. First, this study relies on the data from a 4-year online study report, which may limit the conclusions over a period of time. Therefore, future study should include more reports across different periods. Second, questionnaire surveys should be used to collect first-hand data regarding online learning reflections and feedback among adult online learners. Additionally, the data of the report only investigated Harvard and MIT at the EdX online learning platform. Thus, future studies should include other online course providers and online learning platforms for further data analysis so as to make comprehensive conclusions.

## References

- Blackmore, J. (1996) 'Pedagogy: learning styles', in *Telecommunications for Remote Work and Learning*. Available at: <http://granite.cyg.net/~jblackmo/diglib/styl-a.html>
- Blagojević, M. & Milošević, D. (2015) 'Massive open online courses: EdX vs Moodle MOOC', *5th International Conference on Information Society and Technology*, Kopaonik, Serbia, pp. 346–351.
- Bonk, C. J. & Reynolds, T. H. (1997) 'Learner-centered Web instruction for higher-order thinking, teamwork, and apprenticeship', *Web-Based Instruction*, vol. 8, no. 11, pp. 167–178.
- Brophy, J. & Alleman, J. (1991) 'Activities as instructional tools: a framework for analysis and evaluation', *Educational Researcher*, vol. 20, no. 4, pp. 9–23. doi: 10.3102/0013189X020004009
- Cercone, K. (2008) 'Characteristics of adult learners with implications for online learning design', *AACE Journal*, vol. 16, no. 2, pp. 137–159.
- Ch, S. K. & Popuri, S. (2013) 'Impact of online education: a study on online learning platforms and edX', *2013 IEEE International Conference in MOOC, Innovation and Technology in Education (MITE)*, IEEE, Jaipur, India, pp. 366–370.
- Chuang, I. & Ho, A. (2016) 'HarvardX and MITx: Four Years of Open Online Courses – Fall 2012–Summer 2016', Available at: <http://dx.doi.org/10.2139/ssrn.2889436>
- Cross, K. P. (1981) *Adults as Learners*. San Francisco, CA: Jossey-Bass.
- Cundell, A. & Sheepy, E. (2018) 'Student perceptions of the most effective and engaging online learning activities in a blended graduate seminar', *Online Learning*, vol. 22, no. 3, pp. 87–102. doi: 10.24059/olj.v22i3.1467
- Dabbagh, N. (2007) 'The online learner: characteristics and pedagogical implications', *Contemporary Issues in Technology and Teacher Education*, vol. 7, no. 3, pp. 217–226.
- Davis, J. R. (1972) 'The changing college calendar', *The Journal of Higher Education*, [online] vol. 43, no. 2, pp. 142–150. Available at: <https://www.learntechlib.org/primary/p/22904/>
- Diaz, D. P. (1999) 'CD/Web hybrids: delivering multimedia to the online learner', *Journal of Educational Multimedia and Hypermedia*, [online] vol. 8, no. 1, pp. 89–98. Available at: <https://www.learntechlib.org/primary/p/10810/>
- Diaz, H. J. P., et al., (2015) 'Using video visualizations in open edX (to understand learning interactions of students)', *Design for Teaching and Learning in a Networked World*, Springer, Cham, pp. 522–525.
- Freire, M., del Blanco, Á. & Fernández-Manjón, B. (2014) 'Serious games as edX MOOC activities', *2014 IEEE Global Engineering Education Conference (Educon)*, IEEE, Istanbul, Turkey, pp. 867–871.
- Gaebel, M. (2013) 'MOOCs – Massive open online courses', *EUA Occasional Papers*, available at: <http://www.eua.be>, accessed December 6, 2016
- Gao, F., Zhang, T. & Franklin, T. (2013) 'Designing asynchronous online discussion environments: recent progress and possible future directions', *British Journal of Educational Technology*, vol. 44, no. 3, pp. 469–483. doi: 10.1111/j.1467-8535.2012.01330.x
- Gold, H. E. (2005) 'Engaging the adult learner: creating effective library instruction', *Portal: Libraries and the Academy*, vol. 5, no. 4, pp. 467–481. doi: 10.1353/pla.2005.0051
- Herrington, J., et al., (2004) 'Designing authentic activities in web-based courses', *Journal of Computing in Higher Education*, vol. 16, no. 1, pp. 3–29. doi: 10.1007/BF02960280
- Hollands, F. M. & Tirthali, D. (2014) *MOOCs: Expectations and Reality*, Center for Benefit-Cost Studies of Education, Teachers College, Columbia University. Available at: [https://www.academia.edu/download/33728665/MOOCs\\_Expectations\\_and\\_Reality.pdf](https://www.academia.edu/download/33728665/MOOCs_Expectations_and_Reality.pdf)
- Jaramillo-Morillo, D., et al., (2017) 'Follow-up of learning activities in open edX: a case study at the University of Cauca', *European Conference on Massive Open Online Courses*, Springer, Cham, pp. 217–222.
- Kauffman, H. (2015) 'A review of predictive factors of student success in and satisfaction with online learning', *Research in Learning Technology*, vol. 23, pp. 1–13. doi: 10.3402/rlt.v23.26507

- Mazzolini, M. & Maddison, S. (2007) 'When to jump in: the role of the instructor in online discussion forums', *Computers & Education*, vol. 49, no. 2, pp. 193–213. doi: 10.1016/j.compedu.2005.06.011
- Merriam, S. B., & Bierema, L. L. (2014). *Adult learning: Linking theory and practice*. San Francisco, CA: Jossey-Bass.
- Mitros, P. F., et al., (2013) 'Teaching electronic circuits online: lessons from MITx's 6.002 x on edX', *2013 IEEE International Symposium on Circuits and Systems (ISCAS)*, IEEE, Beijing, China, pp. 2763–2766.
- National Center for Education Statistics. (2001) *Distance Education at Postsecondary Education Institutions: 2000–2001*. Available at: <https://nces.ed.gov/pubs2003/2003017.pdf>
- National Center for Education Statistics. (2019) *Digest of Education Statistics: 2019*. Available at: <https://nces.ed.gov/pubs2019/2019144.pdf>
- Nguyen, V. A. (2017) 'The impact of online learning activities on student learning outcome in blended learning course', *Journal of Information & Knowledge Management*, vol. 16, no.4, pp. 1750040. doi: 10.1142/S021964921750040X
- Pardos, Z. A., et al., (2013) 'Adapting Bayesian knowledge tracing to a massive open online course in edX', *EDM*, vol. 13, pp. 137–144.
- Park, J. (2007) 'Factors related to learner dropout in online learning', in *Proceedings of the 2007 Academy of Human Resource Development Annual Conference*, eds F. M. Nafukho, T. H. Chermack & C. M. Graham, AHRD, Indianapolis, IN, pp. 25-1–125-8.
- Park, J. H. & Choi, H. J. (2009) 'Factors influencing adult learners' decision to drop out or persist in online learning', *Journal of Educational Technology & Society*, vol. 12, no. 4, pp. 207–217.
- Parry, M. (2012, October 1). Five ways that edX could change education. *The Chronicle of Higher Education*. Available at: <https://www.chronicle.com/article/5-ways-that-edx-could-change-education/>
- Roper, A. R. (2007) 'How students develop online learning skills', *Educause Quarterly*, [online] vo. 30, no. 1, pp. 62–65. Available at: [https://www.vistacampus.gov/system/files/legacy/37/VISTABlend/documents/how\\_students\\_develop\\_online\\_learning\\_skills.pdf](https://www.vistacampus.gov/system/files/legacy/37/VISTABlend/documents/how_students_develop_online_learning_skills.pdf)
- Ruiz, J. S., et al., (2014) 'Towards the development of a learning analytics extension in open edX', *Proceedings of the Second International Conference on Technological Ecosystems for Enhancing Multiculturality*, Salamanca, Spain, pp. 299–306.
- Sanchez-Gordon, S. & Luján-Mora, S. (2013) 'Web accessibility of MOOCs for elderly students', *2013 12th International Conference on Information Technology Based Higher Education and Training (ITHET)*, IEEE, Antalya, Turkey, pp. 1–6.
- Sanchez-Gordon, S. & Luján-Mora, S. (2016) 'How could MOOCs become accessible? The case of edX and the future of inclusive online learning', *Journal of Universal Computer Science*, vol. 22, no. 1, pp. 55–81.
- Shah, D. (2016) 'MOOC aggregator class central', *Proceedings of the Second International Conference on Technological Ecosystems for Enhancing Multiculturality*, Salamanca, Spain, pp. 299–306.
- Shrivastava, A. (2018) 'Using connectivism theory and technology for knowledge creation in cross-cultural communication', *Research in Learning Technology*, vol. 26, pp. 1–16. doi: 10.25304/rlt.v26.2061
- Simonds, T. A. & Brock, B. L. (2014) 'Relationship between age, experience, and student preference for types of learning activities in online courses', *Journal of Educators Online*, vol. 11, no. 1, p. n1. doi: 10.9743/JEO.2014.1.3
- Simonson, M. R., et al., (1997) *Distance Education: Review of the Literature*. Washington, DC: Association for Educational Communications and Technology.
- Stein, D. & Glazer, H. R. (2003) 'Mentoring the adult learner in academic midlife at a distance education university', *The American Journal of Distance Education*, vol. 17, no. 1, pp. 7–23. doi: 10.1207/S15389286AJDE1701\_2

- Waits, T., & Lewis, L. (2003). *Distance education at degree-granting postsecondary institutions: 2000–2001*. Washington, DC: U.S. Department of Education, National Center for Education Statistics
- Waits, T. (2003) *Distance Education at Degree-Granting Postsecondary Institutions: 2000–2001*. National Center for Education Statistics.
- Wang, M., *et al.*, (2009) ‘The impact of mobile learning on students’ learning behaviours and performance: report from a large blended classroom’, *British Journal of Educational Technology*, vol. 40, no. 4, pp. 673–695. doi: 10.1111/j.1467-8535.2008.00846.x
- Zhang, A., Culbertson, B. & Paritosh, P. (2017) ‘Characterizing online discussion using coarse discourse sequences’, *Proceedings of the International AAAI Conference on Web and Social Media*, Montreal, Canada, pp. 357–366.