A Conceptual Framework to Investigate Libyan Students' Readiness to Learn Computer Science Subjects Using Massive Open Online Course (MOOC)

Noureddon H. Ibrahim Beleid
nooreb@yahoo.com
Higher Institute of Sciences and Technology
Soq Alkamis Msehel

Abstract

The The dawn of Massive Open Online Courses (MOOCs) has revolutionized the educational landscape, offering unprecedented access to quality education. This paper explores the readiness of Libyan students to engage in computer science subjects via MOOCs, a modality that promises to overcome traditional educational barriers. The study aims to assess the advantages and challenges associated with MOOC adoption among Libyan students and proposes a conceptual framework to facilitate this investigation. Key variables such as internet discussion, technology access, technology skills, and motivation are examined to determine their impact on students' readiness for MOOC-based learning. The findings highlight the potential of MOOCs to enhance learning outcomes and provide cost-effective educational opportunities for students in Libya. This study contributes to the understanding of MOOC implementation in developing countries and offers insights into improving the integration of online learning platforms in the educational systems of such regions.

Keywords: Computer Science, Massive Open Online Course, Connectivist Learning Theory, Conceptual Framework, Libyan Students

1.0. Introduction

Massive Open Online Courses (MOOCs) are the latest trend in educational institutions around the world. MOOCs are best described by McAuley et al. (2010) as "an integration of the connectivity of social networking, the facilitation of an acknowledged expert in a field of study, and a collection of freely accessible online resources." MOOCs are also viewed as a scalable solution for open and online education with some considering them to have significant political and social implications (Kop, 2011). Computer Science is considered one of the essential pillars of scientific knowledge. However, learning Computer Science is challenging for a wide segment of students, prompting educational institutions and authorities to address these challenges. According to Smith (2013), students achieve higher performance in Computer Science when they spend more time learning outside the classroom where an interactive environment enhances learning. MOOCs represent a significant step towards breaking the constraints of traditional course knowledge, allowing students to go beyond the limitations of teacher-led and textbook-based learning. Educational institutions, including primary and secondary schools, must continue to enhance their strengths and maintain positive perceptions with websites offering valuable opportunities for this improvement (Caglar & Mentes, 2012). The importance of MOOCs has increased significantly over the past decade with research showing that MOOCs can contribute to student learning and improve

academic results across various subjects (Chauhan, 2014; Zhang, 2018; Huang et al., 2020). This study explores the potential for Libyan students to learn Computer Science through MOOC platforms. Currently, there is a limited number of studies focused on learning Computer Science through MOOCs in Libya. By using MOOC platforms, students can be located anywhere globally, requiring only internet access (Levy & Schrire, 2015). This approach allows Libyan and other students to reduce the costs associated with studying abroad and provides the flexibility to study from any location (Ruth, 2012).

2.0 Literature Review

MOOC Background

The term Massive Open Online Course (MOOC) was introduced in 2008 to describe a course created by Stephen Downes and George Siemens initially called Connectivism and Connectivity Knowledge (Cheah, 2016). Their goal was to explore the potential for collaboration among large groups of participants using the internet and other online tools, creating a richer learning environment than traditional methods allowed. At the University of Manitoba, 25 students attended the course in person while another 2,300 participated online from around the world. MOOCs that emphasize cooperation and networking are known as cMOOCs. In 2011, Stanford University offered three MOOCs for free, including an Introduction to Artificial Intelligence course taught by Peter Norvig and Sebastian Thrun, which attracted over 160,000 registered students globally with more than 20,000 successfully completing the course

Benefits of MOOC

European institutions use MOOCs to attract new students by offering dynamic learning opportunities (Jansen & Schuwer, 2015). The media coverage of MOOCs can help institutions

broaden their student market and achieve marketing benefits (Jenner & Strawbridge, 2015). MOOCs provide institutions with opportunities to innovate new platforms and offer courses in various disciplines (Prades et al., 2015). MOOCs also encourage the formation of international and local partnerships, enhancing the quality of courses offered (Pscheida et al., 2015).

MOOCs offer institutions the ability to create meaning through learning analytics (Yousef et al., 2015). They are gaining support due to their ability to provide access to quality education for all (Andone et al., 2015). MOOCs promote best teaching practices through tweets, blogs, and status updates by instructors (Kilgore et al., 2015). On-campus students who engage with MOOCs benefit from the innovative and interactive teaching methods (Roland et al., 2015). Experimentation with pedagogy, such as combining MOOCs with on-campus courses, facilitates global discussions and sharing of opinions (Docq & Ella, 2015). Flipped classrooms help non-campus students feel connected to top universities (Roland et al., 2015). MOOCs also help students build specific skills and enhance personal growth (Malc, 2015, Bakon et al., 2021).

Challenges of MOOC

Modern education involves various factors such as pedagogical theories, active learning relevance, teaching methods, and the increasing demand for in-person learning. MOOCs face challenges like high dropout rates and cost pressures on education providers. They rely heavily on advanced technologies, requiring providers to be skilled in ICT and digital instruction. This often leads to outsourcing to external academicians, increasing administrative costs (Houston, 2013).

Designing MOOC curricula requires attention to meet learning outcomes and engage learners through video instructions (Cheah, 2016). Issues such as video quality, downloading speed, and the need for transcripts are significant challenges (Mihaescu et al., 2016). MOOCs conducted in English can exclude non-English speakers (Cheah, 2016). Higher dropout rates are associated with MOOCs due to various factors, including the lack of peer feedback and the time constraints of fully working adult students (Ho et al., 2015; Koller et al., 2013; Colman, 2013; Morris et al., 2015).

MOOC Theories Development

Discussions on MOOCs distinguish between two formats based on pedagogical underpinnings: cMOOCs and xMOOCs. cMOOCs are based on connectivism, emphasizing community, understanding systems, and networked learning. Students use technology, information systems, and various media to achieve their goals and share knowledge through their networks. xMOOCs, typically offered by renowned universities, focus on personal understanding through standard lectures and assessments, following a cognitive-behaviorist approach (Conole, 2013).

MOOCs have seen a rapid rise in popularity since 2012. An analysis of MOOCs offered by 66 American institutions identified six common goals: (i) expanding educational access, (ii) enhancing institutional reputation, (iii) improving financial outcomes, (iv) enhancing instructional outcomes, (v) advancing teaching and learning, and (vi) conducting top-tier research on learning and teaching (Jordan, 2015). However, MOOCs have faced criticism for not democratizing education as intended, with only a small percentage of institutions generating revenue from MOOCs. Challenges include lack of clarity regarding participant data and instructional outcomes, and difficulties in

assessing the impact on institutional brands and educational outcomes.

The Theory of Connectivist Learning

Siemens (2005) defined connectivism as the process of linking information sources or specialized nodes. Learning occurs through the connections within a network, often beyond the direct control of an individual. Connectivism integrates principles from complex self-organization theories, focusing on connecting and networking individuals through digital platforms like social media, wikis, and blogs to share opinions and develop knowledge. The theory posits that learning is concentrated on connecting information groups and that these connections are more important than current knowledge levels. New information is continually acquired and integrated into the learning network.

The Proposed Conceptual Framework

Based on previous studies that examined the readiness of individuals for the MOOC. The four dimensions of readiness assigned to be tested are shown in Figure 1.

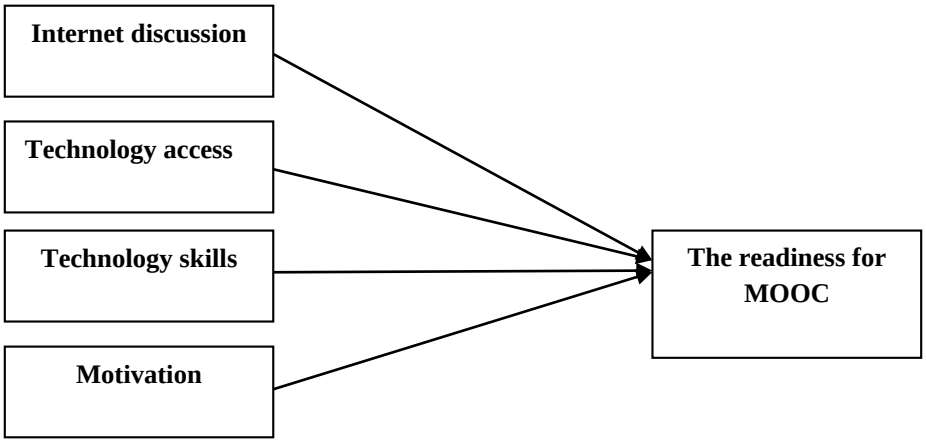

Figure 1: Conceptual framework

Explanations of Variables within the Framework

Internet Discussion

Professionals have examined distinct stages of participation in online and distance learning classes, integrating the characteristics of online students (Noel Levitz, 2011). Several studies use unsystematic instances tracked to assess the impacts of numerous approaches to online learning. The adaptability of discoveries from online and distance learning classes to MOOCs is obscure due to several distinctions in goals and class frameworks. In contrast to conventional online learning, MOOCs and distance learning classes are not planned to accommodate substantial numbers of students, nor are they typically designed for students who frequently transfer in and out of classes. MOOCs can be categorized as more uniform and focused compared to other large-scale online efforts, such as China's Open University or Turkey's Anadolu University. Findings are required from further study on MOOCs. Despite enrolling large numbers of registrants, MOOCs are characterized by very low achievement rates. Determinations of achievement and dropout rates may vary, depending on the metrics used. Numerous reports indicate that achievement rates generally vary between 1-2% to 5% of registrants (Ho et al., 2014). An evaluation of 17 MOOCs offered by Harvard and the Massachusetts Institute of Technology in 2012 and 2013 found that 5% of more than 840,000 registered learners successfully completed their courses and received certificates of achievement (Ho et al., 2014).

Technology Access

According to Tharindu et al. (2015), the rapid and unexpected pace of change has tremendously led to the creation of technologies, impacted globalization, and made critical

knowledge economical and easy to access. This, in turn, has led to the growth of competition among industries worldwide. Knowledge has become an important commodity, particularly within the international labor market. The economic advantage will originate in states where the public attains adequacy in training, applying, and managing information into actionable knowledge. The modern workplace demands new ways of operating, relying heavily on high skills and specialist knowledge (Brown, 2001, Bakon, et al., 2020). Post-secondary education, seen as an information propagator and originator, creates knowledge that propels innovation and change. Thus, post-secondary education is regarded as an integral driver that ensures propulsion for globalization. Conversely, globalization also shapes post-secondary education. With the advent of the new market, where knowledge workers gain value, it is consequential to anticipate a significant impact on post-secondary education (Tharindu, 2012). Higher education proposals worldwide have contemplated substantial changes recently, including privatization. This type of privatization involves the shift from public instructional funding to either cost-recovery techniques or cost-sharing techniques. For instance, higher education institutions in Australia charge full fees to foreign students while offering reduced rates to local students; a similar scheme is applied by institutions in the United Kingdom for both local and foreign students.

Technology Skills

Hoy (2014) indicates that MOOCs can provide a viable and temperate approach to continuous professional development, especially given the diminishing business funding for professional training. MOOCs can be an optimal strategy to frequently update one's skill set. For instance, a software engineer may have expertise in using a particular programming language, but for an upcoming project, acquiring skills in a

different language might be required. In this case, a MOOC could be a beneficial method to quickly learn the new programming language. Similarly, a medical professional might desire to work with specific imaging data and could use a MOOC like "Statistical Analysis of fMRI Data" offered by Johns Hopkins University on Coursera to acquire the necessary new skills. Due to the fact that MOOCs are free and have no penalties for non-completion, they provide anyone interested with an opportunity to explore various subjects.

Although the use of MOOCs could facilitate the advancement of such adaptability in adult major skills learners, it depends on how one implements the MOOC. Estimated, MOOCs could integrate any information-sharing and learning structure.

Motivation

Motivation is a critical factor that empowers and sustains learning behavior (Gagné, 1985). Currently, the retention rates of MOOCs are significantly low. It is reported that the average completion rate for MOOCs is below 7%. Breslow et al. (2013) mentioned that 154,763 learners enrolled in their 6.002x Circuits and Electronics course, yet only around 5% completed the course and earned a certificate. It is crucial to understand learners' motivation levels in the context of e-learning. Consequently, educators can then implement the necessary measures to enhance student engagement and learning. However, there is a lack of experiential studies on assessing students' motivation levels in MOOC settings.

The Use of MOOC in Computer Science education

MOOCs have been instrumental in improving the quality of computer science education, especially in regions with limited resources. For instance, a study in sub-Saharan Africa highlights how MOOCs have been adapted to enhance the

educational standards in computer science by providing access to high-quality learning materials and fostering active learning environments (Mtebe & Kissaka, 2016).

The integration of MOOCs in university settings has reshaped pedagogical approaches. Research has shown that MOOCs, like those offered for introductory computer science, have broken enrollment records and have significantly influenced teaching methodologies (Karsenti, 2013).

MOOCs have been designed to cater to specific audiences, such as teenagers and high school students, to introduce them to computer science concepts. An example is the bilingual MOOC "Code Yourself" which focuses on making computer science accessible to younger learners (De Kereki & Manataki, 2016).

MOOCs have also been used as tools for outreach and recruitment into computer science programs. A study in Puerto Rico utilized a MOOC to increase interest in computer science among teachers and students, which subsequently boosted enrollment in related courses (Ordóñez Franco et al., 2018).

Some universities have developed pre-MOOCs to prepare students for advanced computer science courses. These MOOCs aim to bridge the knowledge gap and equip students with the necessary foundational skills (Spieler et al., 2020).

MOOCs have also been explored as supplementary tools in secondary education to enhance computer science competencies among students. Studies indicate that these courses can effectively complement traditional teaching methods and provide additional resources for learning (Grella et al., 2017).

Research has examined the role of MOOCs in addressing gender disparities in computer science education. Findings suggest that tailored MOOCs can help in retaining women in

computer science programs by addressing their specific learning goals and participation patterns (Crues et al., 2018).

MOOCs have been studied for their effectiveness in fostering self-regulation among students. High school students participating in a MOOC for the AP Computer Science course demonstrated improved self-regulation skills, which were correlated with better performance in programming tasks (Sands & Yadav, 2020).

MOOCs have potential in bridging educational gaps by making computer science education accessible to underrepresented groups. A study focused on Finnish schools highlighted how a purposeful MOOC could alleviate the shortage of computer science education resources (Kurhila & Vihavainen, 2015).

Conclusion

Instructor leverage, student mastery, student throughput, student engagement, the opportunity offers to students to learn important disciplines, facilitating coaching of concepts and tools and serving as bridging subjects are some of the advantages computer science students using MOCC could benefit . The variables discussed under the conceptual frameworks would enable scholars to investigate thoroughly the readiness of MOOC among students of any subject. This framework could researchers to conduct thorough investigations and provide empirical evidence regarding the phenomenon of high drop-out rate of students learning via MOOCs.

References

Andone, D., Mihaescu, V., Ternauciuc, A., & Vasiu, R. (2015). Integrating MOOC in traditional higher education. Paper presented at the European MOOCs Stakeholders Summit 2015 Conference, Université Catholique de Louvain, Mons, Belgium. Retrieved from http://www.emoocs2015.eu/

Bakon, K. A., Elias, N. F., & Abusamhadana, G. A. (2020). Culture and digital divide influence on e-government success of developing countries: A literature review. *Bakon, Kinn Abass, Culture and digital divide influence on e-government success of developing countries: A literature review (15*, 1362-1378.

Bakon, K. A., Elias, N. F., & Jenal, R. (2021). Conceptual framework of value in use and e-learning success. In *2021 International Conference on Electrical Engineering and Informatics (ICEEI)* (pp. 1-6). IEEE.

Breslow, L., Pritchard, D. E., DeBoer, J., Stump, G. S., Ho, A. D., & Seaton, D. T. (2013). Studying learning in the worldwide classroom: Research into edX's first MOOC. Research & Practice in Assessment, 8(1), 13-25.

Brown, P., Green, A., & Lauder, H. (2001). High skills: Globalization, competitiveness, and skill formation. Oxford: Oxford University Press.

Caglar, E., & Mentes, S. A. (2012). An exploratory study of Internet and online social network site usage in a Turkish university. Journal of Arts and Humanities, 1(1), 103-111.

Cheah, C. C. (2016). Benefits and challenges of massive open online courses. ASEAN Journal of Open Distance Learning, 8(1).

Chauhan, A. (2014). Massive open online courses (MOOCs): Emerging trends in assessment and accreditation. Digital Education Review, 25, 7-17.

Christensen, G., Steinmetz, A., Alcorn, B., Bennett, A., Woods, D., & Emanuel, E. J. (2013). The MOOC phenomenon: Who takes massive open online courses and why? Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2350964

Colman, D. (2013). MOOC interrupted: Top 10 reasons our readers didn't finish a massive open online course. Open Culture. Retrieved from http://www.openculture.com/2013/04/10_reasons_you_didnt_complete_a_MOOC.html

Conole, G. (2013). MOOCs as disruptive technologies: Strategies for enhancing the learner experience and quality of MOOCs. Retrieved from http://eprints.rclis.org/19388/

De Kereki, I. F., & Manataki, A. (2016). "Code Yourself" and "A Programar": A bilingual MOOC for teaching computer science to teenagers. IEEE Frontiers in Education Conference (FIE). Retrieved from https://ieeexplore.ieee.org/abstract/document/7757569/

Docq, F., & Ella, H. (2015). Why make MOOC? Effects on on-campus teaching and learning. Paper presented at the European MOOCs Stakeholders Summit 2015 Conference, Université Catholique de Louvain, Mons, Belgium. Retrieved from https://www.emoocs2015.eu/

Follis, C. (2015). Variables predicting the retention of community college students in online courses. (Doctoral dissertation). University of Missouri-Columbia.

Gagné, R. M. (1985). The conditions of learning and theory of instruction (4th ed.). New York, NY: Holt, Rinehart & Winston.

Grella, C. T., Staubitz, T., Teusner, R., & Meinel, C. (2017). Can MOOCs support secondary education in computer science? In J. Mason, S. Boyd-Davis, & M. Tscheligi (Eds.), Innovations in Learning and Technology for the Workplace and Higher Education (pp. 567-580). Cham: Springer. Retrieved from https://link.springer.com/chapter/10.1007/978-3-319-50337-0_45

Ho, A. D., Reich, J., Nesterko, S., Seaton, D. T., Mullaney, T., Waldo, J., & Chuang, I. (2014). HarvardX and MITx: The first year of open online courses (HarvardX and MITx Working Paper No. 1). Cambridge, MA: Harvard University/MIT. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2381263

Ho, A. D., Chuang, I., Mitros, P., & Pritchard, D. E. (2015). Who does what in a massive open online course? Communications of the ACM, 54(7), 58-65.

Houston, W. W. (2013). Online college courses: Outsourcing education. The Economist. Retrieved from http://www.economist.com/blogs/democracyinamerica/2013/05/onlinecollege-courses

Hoy, M. B. (2014). MOOCs 101: An introduction to massive open online courses. Medical Reference Services Quarterly, 33(1), 85-91.

Jansen, D., & Schuwer, R. (2015). Institutional MOOC strategies in Europe: Status report based on a mapping survey conducted in October - December 2014. Retrieved from

http://eadtu.eu/documents/Publications/OEenM/Institutional_MOOC_strategies_in_Europe.pdf

Jenner, M., & Strawbridge, F. (2015). UCL's extended learning landscape. Paper presented at the European MOOCs Stakeholders Summit 2015 Conference, Université Catholique de Louvain, Mons, Belgium. Retrieved from http://www.emoocs2015.eu/

Karsenti, T. (2013). The MOOC: What the research says. International Journal of Technologies in Higher Education, 10(2), 23-34.

Kilgore, W., Bartoletti, R., & Al Freih, M. (2015). Design intent and iteration: The #HumanMOOC. Paper presented at the European MOOCs Stakeholders Summit 2015 Conference, Université Catholique de Louvain, Mons, Belgium. Retrieved from http://www.emoocs2015.eu/

Koller, D., Ng, A., Do, C., & Chen, Z. (2013). Retention and intention in massive open online courses: In depth. EDUCAUSE Review, 48(3), 62-63.

Kurhila, J., & Vihavainen, A. (2015). A purposeful MOOC to alleviate insufficient CS education in Finnish schools. ACM Transactions on Computing Education (TOCE), 15(2), 10.

Levy, D., & Schrire, S. (2015). Developing a massive open online course (MOOC) at a College of Education: Narrative of disruptive innovation? Current Issues in Emerging eLearning, 2(1), 8.

Malc, A. (2015). MOOC in Amdocs – Corporate learning based on MOOC's methodology. Paper presented at the European MOOCs Stakeholders Summit 2015 Conference, Université Catholique de Louvain, Mons, Belgium. Retrieved from http://www.emoocs2015.eu/

McAuley, A., Stewart, B., Siemens, G., & Cormier, D. (2010). The MOOC model for digital practice. Retrieved from www.elearnspace.org/Articles/MOOC_Final.pdf

Mihaescu, V., Andone, D., & Vasiu, R. (2016). An analysis of different MOOC environments from the students' perspective. Paper presented at the European MOOCs Stakeholders Summit 2016 Conference, University of Graz, Austria. Retrieved from http://www.emoocs2016.eu

Morris, N. P., Hotchkiss, S., & Swinnerton, B. (2015). Can demographic information predict MOOC learner outcomes? Paper presented at the European MOOCs Stakeholders Summit 2015 Conference, Université Catholique de Louvain, Mons, Belgium. Retrieved from http://www.emoocs2015.eu/

Mtebe, J. S., & Kissaka, M. M. (2016). Enhancing the quality of computer science education with MOOCs in sub-Saharan Africa. Handbook of Research on Active Learning and the Flipped Classroom Model in the Digital Age (pp. 363-379). IGI Global. Retrieved from https://www.igi-global.com/chapter/enhancing-the-quality-of-computer-science-education-with-moocs-in-sub-saharan-africa/141013

Ordóñez Franco, P., Carroll-Miranda, J., & Rodriguez, J. (2018). Incorporating computational thinking in the classrooms of Puerto Rico. Proceedings of the 49th ACM Technical Symposium on Computer Science Education (SIGCSE '18). Retrieved from https://dl.acm.org/doi/abs/10.1145/3159450.3159544

Prades, G. M., Palau, J., Granados, P. C., de Callataÿ, G., & Moureau, S. (2015). An unconventional MOOC as a solution for short budgets and young researchers in

Europe. Paper presented at the European MOOCs Stakeholders Summit 2015 Conference, Université Catholique de Louvain, Mons, Belgium. Retrieved from http://www.emoocs2015.eu/

Pscheida, D., Hoppe, C., Lißner, A., Sexauer, A., Müller, M., & Koehler, T. (2015). Massive open online courses as a tool for student counselling and study guidance: The example of MOOC@TU9. Paper presented at the European MOOCs Stakeholders Summit 2015 Conference, Université Catholique de Louvain, Mons, Belgium. Retrieved from http://www.emoocs2015.eu/

Roland, N., Uyttebrouck, E., & Emplit, P. (2015). A new participative space for MOOC: Overtaking technological evolution to achieve educational innovation. Paper presented at the European MOOCs Stakeholders Summit 2015 Conference, Université Catholique de Louvain, Mons, Belgium. Retrieved from http://www.emoocs2015.eu/

Röthler, D., & Creelman, A. (2016). Learning design and conceptual issues: Is there a conflict between open and closed learning spaces? Can closed facilitate openness? Paper presented at the European MOOCs Stakeholders Summit 2016 Conference, University of Graz, Austria. Retrieved from http://www.emoocs2016.eu

Sands, P., & Yadav, A. (2020). Self-regulation for high school learners in a MOOC computer science course. Proceedings of the 51st ACM Technical Symposium on Computer Science Education (SIGCSE '20). Retrieved from https://dl.acm.org/doi/abs/10.1145/3328778.3366818

Siemens, G. (2005). Connectivism: A learning theory for the digital age. International Journal of Instructional Technology and Distance Learning, 2(1), 3-10.

Spieler, B., Grandl, M., Ebner, M., & Slany, W. (2020). Bridging the gap: A computer science pre-MOOC for first semester students. Electronic Journal of e-Learning, 18(6), 550-561. Retrieved from https://eric.ed.gov/?id=EJ1267506

Tharindu, R. L., Andrew, A. A., & Williams, S. A. (2013). MOOCs: A systematic study of the published literature 2008–2012. International Review of Research in Open and Distance Learning, 14(3), 201-227.

Yousef, A. M. F., Chatti, M. A., Schroeder, U., Wosnitza, M., & Jakobs, H. (2015). The state of MOOCs from 2008 to 2014: A critical review and future visions. International Review of Research in Open and Distributed Learning, 16(6), 89-112.

Zhang, X. (2018). Exploring the impact of MOOCs on Chinese higher education: A literature review. International Journal of Information and Education Technology, 8(1), 1-5.