Framework for Personalizing Mooc Courses Based on Learners' Stress Levels Towards Increased Course Completion Rates

Surendheran Kaliyaperumal, Mallika Vijayakumar, Siva Rama Krishnan S

Abstract: ***Massive Open Online Courses (MOOC) has gained a huge popularity amongst the current generation students mainly because of its open nature and its ubiquity. MOOC made it possible for thousands of aspiring learners to learn from their favorite Universities. Though this online learning platform has its advantages, many studies have proved that these massive courses are suffering from tremendous rates in students' drop-outs. This study surveys the major causes of dropouts and would try to link the MOOC failures with the learners' stress levels. The study also proposes a framework which could be used while designing MOOC courses and will help MOOC providers to personalize the content delivery according to the online learners' stress levels.***

Index Terms: MOOC, stress levels, fitness trackers, education, smartphone apps

I. INTRODUCTION

Massive Open Online Courses abbreviated as MOOC is one of the emerging technologies in higher studies. These online based video lectures are represented in many forms such as global, free education, distance learning, open access and so on. MOOCs are based on collectivist peer learning model suggested by George Siemens [1] and it became increasingly popular since the year 2008. Since then, there were several private and government bodies started to offer free and paid education over the internet for all potential learners in the world. Some of the popular MOOC providers are eDX, Udacity, Coursera, and Udemy.

Many of the online courses provided by these popular MOOC platforms are really massive allowing hundreds and thousands of students to enroll in their courses. But the real problem of the MOOC platform as supported by many studies is that the retention rate of the enrolled students [2]. Though there are a thousand students enrolled in a course it's shocking to know that only 10% of the enrolled students complete their courses successfully.

There are several types of research that talks about the reasons behind the dropout rates in MOOC courses but very few studies talked about the mental state of the learners. Numerous studies show that a stressed student cannot perform well in academics [8]. The objective of this particular study is to propose a model that actually considers the stress level of an online learner at the time of exposure to the learning modules and adjusting the course topics according to his/her stress level.

Revised Manuscript Received on July 10, 2019.

Surendheran Kaliyaperumal, Visual Communication, Karunya Institute of Technology, Coimbatore, India.

Mallika Vijayakumar, Visual Communication, Karunya Institute of Technology, Coimbatore, India.

Siva Rama Krishnan S, Software and Systems Engineering, Vellore Institute of Technology, Vellore, India.

II. WEARABLE TECHNOLOGY

Another advancement in science and technology is the invention of wearable devices such as glucose monitors, fitness trackers, etc. These devices became very popular among consumers since the year 2014 and been growing ever since [3]. There are several manufacturers who are releasing varieties of fitness trackers but the market is dominated by companies that produce professional grade trackers such as Fitbit, Garmin, polar and so on. These devices have become common among the youth as the awareness of self-monitoring became global [4]. The Ability to synchronize the data wirelessly between the tracker and digital databases such as Google fit, MyFitnessPal (MFP), has made the process of data transfer and monitoring a breeze.

The recent innovation in these self-tracking devices is the incorporation of heart rate monitoring and it's been employed in every other popular fitness trackers and they became affordable too in recent times. The manufacturers of these trackers suggest their customers to wear them even while sleeping so that the software counterpart will gather the data and form a pattern on the stress level of the wearer. The device can record a variety of data from the wearer such as steps taken, calories burned, stairs climbed, heart rate and consolidate the data to approximate the amount of stress the wearer is experiencing, in addition to other interesting approximations about their body conditions.

III. STRESS LEVEL ASSUMPTIONS

The various manufacturers of these trackers have their own smartphone apps/web-based services that are compatible with their tracking hardware and the algorithm that they use to approximate the body movements vary. In this study, the authors are taking Garmin's fitness tracking hardware as an example. The software counterpart or in other words the app that is compatible with all Garmin's fitness trackers is called Connect™. According to Garmin's website, the following sentences explain how Garmin calculates and concludes the wearer's stress level,

"Your device analyzes your heart rate variability while you are inactive to determine your overall stress. Training, physical activity, sleep, nutrition, and general life stress all impact your stress level. The stress level range is from 0 to 100, where 0 to 25 is a resting state, 26 to 50 is low stress, 51 to 75 is medium stress, and 76 to 100 is a high-stress

state. Knowing your stress level can help you identify stressful moments throughout your day. For best results, you should wear the device while sleeping. You can sync your device with your Garmin Connect™ account to view your all-day stress level, long-term trends, and additional details." [5].

The following screenshots show how Garmin visually represent the stress level of the wearer.

Fig.01. Low and High Stress Level readings from Garmin's Connect™ App

IV. LITERATURE SURVEY

There was a study conducted for students in private dental school [6] in India to find the stress levels. This study also shows the effects of stress on 256 students. The major reason of stress conducted in survey was due to anxiety of facing parents after failure, full overloaded day, and fear of failing course or year. The author discusses that the major solution to address this problem is by counselling and understanding the requirements of students.

The wall street journal [7] carried out a survey about how stress affects students based on school environment. In classroom environment, absence of material resources and teachers' superficial respect and support from colleagues, is allied with children's learning and emotional problems.

Dr. Sian Beilock, psychologist in her research, [8] gave several pointers on how stress affects college students. Some of the findings in her research study were: adjusting to college environments, deadlines of various assessments, lack of support, interpersonal relations etc. The American Institute of Stress points out that "stress can have wide ranging effects on emotion, mood, and behavior." Stress affects both students' physical and mental functioning. These negative symptoms could affect the quality of students' academic performance.

In a study, Lily Tomlin [9] surveyed various effects of stress and sources of stress. In the article, he clearly states that stress can majorly affect the productivity and will reduce the decision-making capability of an individual. The stress also effects the health by increasing the blood pressure when stress hormones, such as cortisol and noradrenaline, reach high levels.

The authors investigate the combined effects of academic self-efficacy [10] and stress on the academic performance of 107 non-traditional, largely migrant, minority students and college freshmen at a large urban institution. They developed a survey instrument to amount the level of academic self-efficacy and perceived stress associated with 27 college-related tasks. The authors assessed structural equation models to evaluate the relative importance of stress and self-efficacy in envisaging three academic performance outcomes: first-year college GPA, the number of accumulated credits, and college retention after the first year.

A study conducted by Yousef discussed several opportunities and challenges involved in personalizing the MOOC courses for individual lesson takers. The authors of the study emphasized the importance of delivering a personalized MOOC course as a step towards enhancing the learning experience of the MOOC community. The authors point out the phenomenon of diversity among MOOC learners as a major challenge. The learners' participation would be across 200 different countries and languages [11] and each individual learner will have their own target and preferences in their mind towards completing that online course. The authors strongly point out that the current MOOC platforms are inefficient in personalizing the courses for individual learners.

Another study conducted at the University of Cairo surveyed 379 students who were enrolling in a MOOC course of their choice. The authors of the study have found that only 32% of the enrolled population has successfully completed the course [12]. The authors further found that the main factors that affect the successful completion of an online course rely on the effectiveness of perception among the students, quality of the course content and the quality of interaction with the tutor. The study also revealed a few interesting factors that the completion rate of a MOOC course does not depend neither on the gender of the learner nor the level of study (UG/PG).

An extensive study led by Allison Littlejohn did a quantitative investigation on the learning behaviors of 788 MOOC learners. The study was concentrated on finding a meaning for "self-regulated learning" and the factors that actually motivates them in completing their courses successfully. While concluding their results, the authors state that the learners' background is diverse and it is very important for the MOOC providers to support the learners' situations [13] and their own goals in order for them to complete their course successfully.

In an elaborate systematic literature review carried out by Napoliana Souza expresses that it is important to understand the affection of the online learners towards their online course. The study states that online learners have a strong connection between their affection towards the course and their behavior and cognition [14]. The study strongly suggests that it is important for the MOOC providers to assess affective states in MOOC courses in order to predict the positive and negative reactions from learners and also to make essential changes in the course delivery environment.

According to a research conducted by Watted Abeer, the dropout rates in MOOC platform does not depend only upon the quality and content structure of a MOOC but also depends on the competence level of the students [15]. If the competency level of the student is not up to the mark, even a well-structured MOOC course will fail to deliver.

V. PROPOSED FRAMEWORK & RESULTS

As discussed earlier, the intention of this study is to personalize the MOOC course according to the stress level of the online learner. Many types of research have been done in the area of how stress affects education and also there were several studies that talked about the main problems in MOOC platforms. But not many studies have been found, that connects the stress level of an online learner who is taking lessons. So, this study proposes a model that can allow MOOC course designers to personalize their courses up to a certain extent.

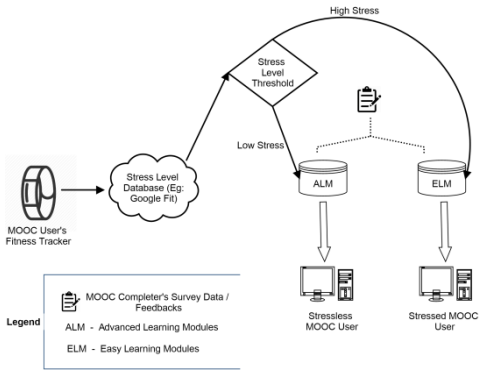

Fig.02. MOOC's Stress Level Management Model

Figure. 02. Clearly shows the proposed model. The stress level of an online learner can be extracted from their fitness tracker database that usually syncs to an online cloud such as Garmin connect, Google fit, etc. so, whenever the MOOC user logs in and starts a lesson, the stress level incurred by that particular user for the past 24 hours will be accessed from their cloud. Again, this study is using Garmin's stress level scales as an example to explain the model. If the stress level of the user in the past 24 hours is below 60 then the model will assume that the learner is in low stress and the MOOC platform will present him a learning module from the advanced learning modules' database of that particular course. If the stress level has been found between 61 to 100, then the model will assume that the user is experiencing medium to a high level of stress and a learning module that is easy to understand will be presented to that user.

VI. ALM & ELM

In this study, the authors represent the term "Advanced Learning Modules" as ALM and "Easy Learning Modules" as ELM. When a MOOC course is designed, the learning modules or chapters will be assigned to it and in return, it makes the content and structure of that particular course. Most MOOC platforms ask for feedback and a quick completion survey about the course from the learners who have successfully completed all the modules. These feedback and surveys can be used to assume which modules in that course was hard to finish by the majority of the learners and which ones were easy on them. So, the list of learning modules where the majority of the learners struggled to pass shall be segregated in a separate database and shall be named advanced learning modules. Those modules which received feedback as "easy" shall form the easy learning module database.

VII. CONCLUSION

There are several existing researches that talks about the reasons behind MOOC drop-outs and also trying to provide solutions to solve them as well. But, as of now, stress level of learners has not been linked as a reason for their drop-out, in any of the research. This framework suggests the MOOC providers not to provide any learning modules that demands Higher Order Thinking from an online learner who are stressed. This study believes that this personalization might lead to higher completion rates. However, this proposed model demands further inferential and implementational analysis which could prove the efficiency of the framework.

VIII. LIMITATIONS

This study presumes that all the learners enrolled in a MOOC course owns a heart rate sensor enabled fitness tracker and also gave their consent to the MOOC provider to access their stress readings from their tracker's cloud.

REFERENCES

1. Baturay, M. H. (2015). An Overview of the World of MOOCs. *Procedia - Social and Behavioral Sciences*, *174*, 427–433. https://doi.org/10.1016/j.sbspro.2015.01.685
2. Greene, J. A., Oswald, C. A., & Pomerantz, J. (2015). Predictors of Retention and Achievement in a Massive Open Online Course. *American Educational Research Journal*, *52*(5), 925–955. https://doi.org/10.3102/0002831215584621
3. Henriksen, A., Mikalsen, M. H., Woldaregay, A. Z., Muzny, M., Hartvigsen, G., Hopstock, L. A., & Grimsgaard, S. (2018). Using fitness trackers and smartwatches to measure physical activity in research: analysis of consumer wrist-worn wearables. *Journal of medical Internet research*, *20(3)*, e110.
4. Ridgers, N. D., McNarry, M. A., & Mackintosh, K. A. (2016). Feasibility and effectiveness of using wearable activity trackers in youth: a systematic review. *JMIR mHealth and uHealth*, *4*(4), e129.
5. Heart Rate Variability and Stress Level. (n.d.). Retrieved from https://www8.garmin.com/manuals/webhelp/vivosmart3/EN-US/GUID-9282196F-D969-404D-B678-F48A13D8D0CB.html
6. Dr. Shashidhar Acharya, "Factors Affecting Stress Among Indian Dental Students", Journal of Dental Education, Volume 67, Number 10, 2003.
7. Strauss, V. (2011, June 10). How much does stress affect learning? Retrieved from https://www.washingtonpost.com/blogs/answer-sheet/post/how-much-does-stress-affectlearn-ing/2011/06/08/AGJCtrNH_blog.html?noredirect=on&utm_term=.d36bb8e76051
8. Stupart, Y. (2018, February 20). How Stress Affects College Students' Academic Performance. Retrieved from https://owlcation.com/academia/College-Life-The-Effects-of-Stress-on-Academic-Performance
9. The Impact of Stress on Academic Success. (2018, November 13). Retrieved from https://www.evokelearning.ca/the-impact-of-stress-on-academic-success/
10. Zajacova, Anna, Scott M. Lynch, and Thomas J. Espenshade. "Self-efficacy, stress, and academic success in college." *Research in higher education* 46.6 (2005): 677-706.
11. Yousef, A. M. F., & Sunar, A. S. (2015). Opportunities and Challenges in Personalized MOOC Experience. ACM WEB Science Conference 2015, Web Science Education Workshop 2015, (May), 3–5.

12. Hone, K. S., & El Said, G. R. (2016). Exploring the factors affecting MOOC retention: A survey study. Computers and Education, 98, 157–168. https://doi.org/10.1016/j.compedu.2016.03.016
13. Littlejohn, A., Hood, N., Milligan, C., & Mustain, P. (2016). Learning in MOOCs: Motivations and self-regulated learning in MOOCs. Internet and Higher Education, 29, 40–48. https://doi.org/10.1016/j.iheduc.2015.12.003
14. Souza, N., & Perry, G. (2019). Identification of Affective States in MOOCs. International Journal for Innovation Education and Research, 6(12), 39–55. https://doi.org/10.31686/ijier.vol6.iss12.1250
15. ABEER, W., & MIRI, B. (2014). STUDENTS' PREFERENCES AND VIEWS ABOUT LEARNING IN A MOOC. PROCEDIA - SOCIAL AND BEHAVIORAL SCIENCES, 152, 318–323. HTTPS://DOI.ORG/10.1016/J.SBSPRO.2014.09.203

AUTHORS PROFILE

Surendheran Kaliyaperumal is a research scholar in the department of Visual Communication at Karunya Institute of Technology, Coimbatore, India. His research area includes ICT, digital pedagogy, VR/AR in education, e-learning, and technology assisted learning methodologies. He had industry experiences with international animation studios and worked in many international animation projects. He has international teaching experiences from United Kingdom, Philippines and China. He holds professional certification from creative software suits – Autodesk Maya, Adobe Photoshop and Unity Technologies.

Mallika Vijayakumar is an assistant professor of Visual Communication at Karunya Institute of Technology, Coimbatore, India. Her research interests include youth, informal learning, new media and online identity. She has contributed to book chapters and also have appeared in many journal publications. Mallika had a successful career as advertising copywriter for two decades apart from her association with academics.

Siva Rama Krishnan, is an Asst. Prof. (Sr) in school of I.T., VIT, Vellore. He has working experience in Centre for Development and Advance Computing (C-DAC) (Ministry of Science and Technology, Govt. of India), as research intern in data center technologies. He is also certified by EMC corp. as a proven professional in Information Storage and Management. Currently an EMC academic alliance faculty and played a key role in establishing a MoU between VIT University and EMC corp. He had proposed and developed an Intelligent Network design framework for building small and large-scale network. He also developed an efficient and secure framework for IP Storage network for C-DAC. His current interest includes e-waste management in India, wireless networks and cloud computing.