

# Online Interaction Model for MOOC Design

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**Abstract:** Presently MOOC has become a popular medium of learning. However, main challenge found from MOOC studies is high dropouts or low learner's retention in using MOOC. One of the solutions is by providing effective design of MOOC to ensure high quality course and for learners to have meaningful experience. Many studies are improving MOOC learning design to suit MOOC environment. However, designing MOOC is challenging process because of the nature of online learning. Moreover, the design needs to suit learner's needs, at the same time meet the pedagogical goals. Interaction is known to be one of the main factors that can affect learner's motivation and consistency to use and complete the course. Therefore, the interaction component needs to be emphasized in the design model. This study highlights the component of interaction in a MOOC design model which is under the transitioning factors and this study discusses the community, content, assessment and technology components. The study reviews on elements that promote interaction, elaborates the important role of interaction for assessment and summarizes the perspective of the community. The component is important not only to encourage learner's retention and completing the course, but also for the improvement of the functionalities for the teaching and learning process.

**Index Terms:** Massive open online course MOOC, MOOC design, learners' retention, interaction.

## I. INTRODUCTION

A learning program which is known as Massive Open Online Course (MOOC) is not new anymore. The research on MOOC is boosting tremendously in the last few years and has reach almost a decade. The increasing number of institutions and providers' partnership shows the countries' initiative in implementing MOOC at national level while the high number of learners registered shows that there are many learners interested to participate and learn in the courses offered. The learners' reasons to register a course, vary from gaining rewards and recognition like certificate or credit, to expending knowledge and for personal skills development. Some learners intend to complete the whole course while some learners intend to complete selected topics and there are also learners who just wish to explore the course [1]. An interesting finding shows that high percentage of MOOC learners and who demand for MOOC are unemployed [2],[3]. Despite various reasons, the situation shows the

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learners have the will to learn and improve themselves. The initiative is empowerment to the creation of a knowledgeable and better community.

There are many factors that contribute to learner's retention in using MOOC. The factors are triggered by the online nature itself where during online, the time is infinite, and the registration is free. Therefore, no commitment is applied. However, even for a long-term plan, investigation on low retention and dropout issue is important to identify if there are factors that can be controlled. If the factors or issue can be fed by solutions, the situation will benefit the learners where they can achieve their own target or complete the course while the teacher can focus more on the other learners. Moreover, the image of provider can be improved which is hopefully worth the cost of development. There are many MOOC researches which are studying for improvement and aim to mitigate the issue of high dropouts and low retention in the course. Previous research covers several dimensions that include "concept, learning theories, case studies, business model, targets groups, assessment and design" [4]. Course design is one of the dimensions covers by previous studies. This includes improving traditional design to cater the issue arise in MOOC design, whether pedagogical or technological areas. Therefore, this study focusses on improving course design in order to mitigate the low retention and dropout issue.

Next section explores on the design of existing MOOC research, then the study reviews the type of interaction model. In section IV, this study presents the construction of a model with discussion on components that need improvement for content, instruction, community and assessment which also highlights the component of interaction in the learning environment.

## II. MOOC COURSE DESIGN

Design is the earliest stage in MOOC development as part of MOOC lifecycle process [5]. Several components need to be considered in designing MOOC such as content, instruction, assessment and technology [6],[7]. The goals of MOOC design from previous studies are to improve existing model or framework which most of them intended to fill the gaps that differentiate MOOC design with other type of online learning design. Several studies include Grover, Franz [8] and Drake, O'Hara [9] who focused on improving technological area that promotes interactive and engaging system. Apart from that, MOOC design studies also aims to mitigate the low retention problems. At the end, the main goal of the studies is to produce the guideline, model or framework that produced



for MOOC design that are able to provide an effective or successful MOOC. Table 1 shows existing researches on MOOC design.

Table I focuses on the studies that aim to solve the low retention issue. Most of the studies emphasize on the technology aspect like Gené, Núñez [10] who proposed gamification elements or like Höfler, Höfler [11] study that discussed on interactive content. Apart from that, learner, teacher, content, assessment and instruction are core components that need to be considered.

Meanwhile, Lee and Choi [12] had provided a comprehensive work in investigating factors of retention in online learning. The study shows, apart from course design, interaction play important role that affect learner’s retention. An insightful study [13], include his investigation on learners who have dropout by using questionnaire. Some of the reasons given are no motivation, feeling isolated and lack of interaction. Meanwhile, absence of learners’ interaction with activities has become indicator for predicting dropout and retention in previous studies like Nagrecha, Dillon [14], Ramesh, Goldwasser [15] and Khalil and Ebner [16]. The studies show that interaction component play vital role in the MOOC environment. However, the role of interaction which previous research have identified interaction as one of the factors that affect learners’ retention, is less emphasis in MOOC studies [17].

**Table 1.** Existing Research on MOOC Design

| Authors                    | Aspect investigated                                                                                                                                                   | Research goals                                                                                                                   |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Brown et al., 2017         | Pedagogy: teacher, learner participation and assessment.                                                                                                              | Explore and develop guidelines to produce successful MOOC.                                                                       |
| Hofler et al, 2017         | Components of framework: Choice of content, special interactive quiz format, serial videos, narrator, duration and video schedule.                                    | Conduct case study on MOOC which implement based on the design four-week MOOCs, granular certificates, suspense peak narratives. |
| Gene et al., 2014          | Technological, training strategy, cooperative                                                                                                                         | Proposed gamification elements, combine xMOOC and cMOOC.                                                                         |
| Mohamed and Wosnitza, 2014 | Dimensions of pedagogy and technology that include; instructional design, assessment, user interface, video content, learning and social tools and learning analytics | Proposed criteria to be used for designing MOOC. The criteria used in survey for lecturers and learners.                         |
| Xiao et al., 2014          | MOOCs usability and learning resources design based on working memory, cognitive load theory and motivation theory                                                    | Proposed model with components of location, technology, learner characteristics and user experience model.                       |

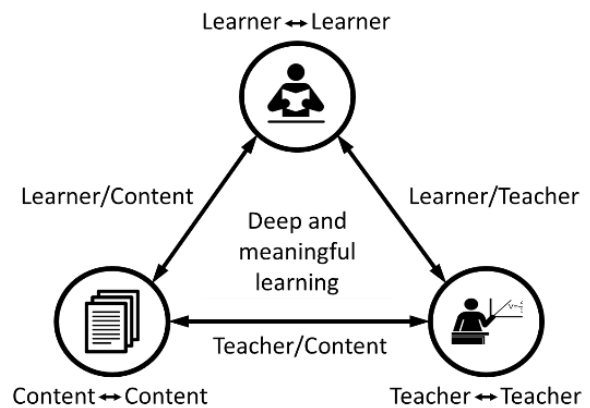
**III. MOTIVATION AND RESEARCH FOCUS**

This section discussed on the role of online interaction in MOOC learning environment starting by review of the type of interaction model and lead the discussion to the goals of this study. Online interaction has been considered in previous MOOC design as an important component and therefore, online interaction including a new type of interaction, an interaction with assessment become focus of this study. Also, another component that affect interaction which is transitioning factors is also being considered for discussion under this section.

**A. Online Interaction**

The term interaction means “an occasion when two or more people or things communicate with or react to each other” [18]. Interaction is associate with the term interactivity and has been used interchangeably. Su, Bonk [19] suggested that the terms just “describe the same thing with difference angles”. Meanwhile, Shin, Shin [20], concluded that interactivity is mostly associate with technologies which describe human-machine or machine-machine interaction. This bring the conclusion where in this study, the term interactive will be used to describe and discussed on technology and the term interaction or specifically online interaction is used to describe relation between components conducted online.

As mentioned in other studies [21]- [23], Moore [24] is one of the earliest researchers that discussed on the type of interaction in distance learning. The interaction among learner, teacher and content is described as important for effective learning. In later studies, learner-self interaction and learner-interface interaction are added [25]. Meanwhile, Wagner [26] divide interaction into system interaction and content interaction. However, the three type of interaction is the most common type being mentioned and discussed by many studies for its application in online learning system including MOOC. Fig. 1 shows the categories discussed by Moore [24], that involves three type of interaction in distance education. The types of interaction are interaction between learner, teacher and content.



**Fig 1.** Learning Interaction [27]

From Fig. 1, learner-content interaction is one of the core elements and



most dominant in any type of online learning [28]. Content is the main component that learner seek when log in to the MOOC. Moreover, content support instruction delivered through activities that connect learners and teachers. Also, content become significant predictor for learner's retention studies [13]. The other high user of content is teacher. Teacher interacts with content such as giving instruction for assignment or task, uploads text for each topics and subtopics. High learner's interaction with the activities is one of the indications of the course quality. Therefore, teacher's role is important to ensure quality of the course which can be maintained by proactive monitoring and participation.

Three types of interaction that is describe as social interaction by most previous studies are learner-teacher, teacher-teacher and learner-learner. In online learning, producing these types of interaction is highly depend on learner or teacher because of their time and space flexibility [29]. Studies from Tawfik [17] described interaction of learner-learner which may occur through various levels that include from lowest level of sharing information to the highest level of applying the new constructed knowledge. The study shows that, as in previous traditional online learning, learner-learner interaction in MOOC is still at the lowest level. However, as for the impact towards retention, learner-learner is perceived to give positive impact on MOOC learning based on the positive result from the usage social communication tools [13]. Apart from that, learner interaction with teacher is reported in most previous studies for giving impact on learners' learning process [30]; [31]. The connection between learner-teacher is very significant that by doing simple interaction like reading and giving instruction, learner can feel teacher's presence. Meanwhile, teacher-teacher interaction is rarely discussed. However, recently the hype of MOOC 4.0 emphasis on this type of interaction where instead of only one teacher interact with learner, a group of teachers work collaboratively to monitor learner's performance. Recently, Özgür and Yurdugül [32] study emphasized one more type of interaction which is learner-assessment that will be discussed more in next section.

## B. Interaction with Assessment

Assessment involve utilizing information about learner's progress to assist them in improving their learning performance. Assessment include the application of analytic tools that can provide and report learner's progress automatically and improve instructional design [33]. Example of tools that using assessment is assignment, choice, lesson, quiz and survey. Spector [34] stated that MOOC cannot be considered a course until it has the assessment and feedback component while Yousef, Chatti [6] concluded from their list of categories resulted from large survey that assessment and learning analytics category is important key for effective MOOC. Learners and teachers interact with the assessment tool to keep update on their performance. In a study on distant learning, assessment is found as one of the activities that mostly applied in learning design [35]. However, interaction with assessment is less

emphasis in previous studies. One study that proposed this type of interaction is Özgür and Yurdugül [32]. In his study based on a learning management system, apart from learner-teacher interaction, learner-assessment interaction consist of assessment task and feedback is found to highly impact learner's achievement. Moreover, it is found that learner who is more likely to make this type of interaction interacts more with content or peers. This finding shows that type of interaction plays important part for learner after studying the course materials and to compare their performance with peers to enhance learning performance.

Meanwhile, for online learning course, analytic is commonly referred to learning analytic. Currently, the analytic available for MOOC include descriptive analytic, predictive analytic, prescriptive analytic [36] and analysis of social contributor which the result of these analytic is send to feedback [37]. Compare to other type of online learning, MOOC need to analyse massive learners. Current research and development in learning analytic area which is active and progressive make the process possible. Moreover, technology like big data tools are available to support the analytic. Fig. 2 shows the element that need to be considered for medium or tools used by learner or teacher when interact with assessment.

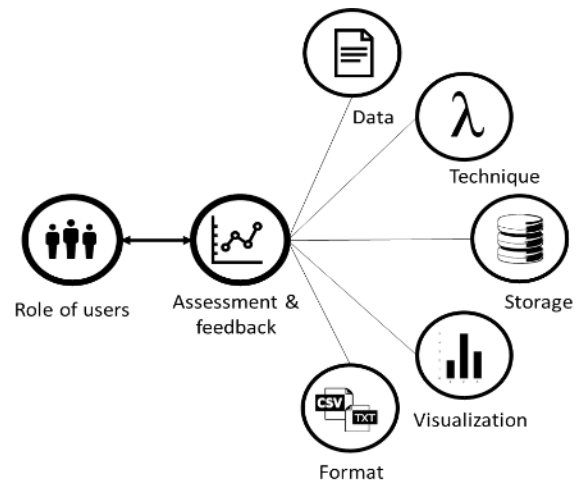


Fig 2. Elements of Assessment

From Fig. 2, assessment access by two important role of users who are learner and teacher. Learner need assessment to evaluate their own performance and to compare their performance with the whole class. Examples of technologies that support analytics tools for learners include statistic result from descriptive analytic that shows how many activities have been done. This include number of videos watched, number of quizzes done, number of assignments submitted, number of questions corrected or current score and even how many time learners' check their own progress. Progress bar is visual tool that shows learner's completion rate. Some platforms provide view in form of pie chart to easily show percentage for each activity. This visual tool is updated automatically whenever they complete another activity.

Meanwhile, from teacher's view, they interact with assessment to do grading task and view current





performance. They are able to view the whole group or individual performance or current progress. Also, with more advance technology, teachers are able to view at risk learners using prediction analytic that shows interaction pattern result such as whether the learner will keep on low score on the next question or, whether the number of learners with high performance will drop in the next week. Other than progress bar and statistical information, sociogram resulted from the social network analysis utilizes data from social media to provide unique and useful graphic for teachers to know the learner's network and shows the learners effort in delivering ideas to others.

In conclusion, elements for assessment learners' massive data that community need to aware of are the target user, type of data used (content of forum or number of activities view), technique employed for the tools, type of visualization (tables, bar chart, pie chart, sociogram), where to process and store the result (internal database or cloud) and format generate (csv file or pdf file). The information provided by these tools is valuable for the improvement of learner's performance, course development, teaching and learning process and ultimately the MOOC learning environment.

### C. Transitioning Factors

Transitioning in learning environment is about 'moving towards and adjusting oneself to another context' [38]. In this study, the transition is related to the factors which are the component that affect learners' retention in the learning environment. These factors are transitioning because the factors can affect and be affected by the other components in long term or short term. The factors can change from one condition to others. For example, the learners can change from self-pace to schedule if the learners are high self-regulated or, the learners changing intention from observation to select topic and eventually will complete the whole course. It is also possible for the learners to require different mode of viewing the course according to where they are such as using basic view when they are in rural place because viewing video is almost impossible in such place. The learner's attitude is also transitioning or changing for several reasons like improved content and peers' encouragement [39] that increase their motivation or satisfaction. To improve the whole learning environment, the factors are improved parallel with the need from community and MOOC learning systems. These transitioning factors also can be related with differentiated instruction which proposed by Tahiri, Bennani [40]. The study also believes that diversification of learners' background is the cause of heterogeneity issue which become interference in designing a good MOOC and indirectly affect MOOC completion rate. Meanwhile, Nordin, Norman [41] suggested more research to be done on developing MOOC to become adaptive learning because learners have different learning style and preferences.

Meanwhile, instruction is also one of the important components in MOOC learning environment. Even though instruction is not the focus in this study, the component is known for improving teaching and learning process. For

example, Kanuka [42] conducted a study where several groups receive difference instructional methods and found that the effect on their interaction are different. This shows that it is important to consider instruction carefully when designing a course. Other factors that worth to be mentioned include mode of study, intention, knowledge and attitude. Other important factors like time is also being discussed in previous studies [43], where survey from crowdsourcing platform shows that one of the main reasons for withdrawal is inability to perform good time management. The problem is solved by developing a tool that support learner's time management. The issue indicates that learners come with various background thus need different styles of time management. From the discussion in previous subsection, there are many transitioning factors that can affect learner's retention including the mode of interaction.

#### 1) Interaction as Transitioning Factor

The success or effectiveness of MOOC depend on the nature of the community which include learner, teacher and other roles like faculty. However, the impact of other components cannot be ignored which include factors that need to be considered when designing MOOC. Supporting the enhancement of the components promote better learning environment. Lee and Choi [12] comprehensive study on the factors that affect learner's retention highlight interaction as one of the factors apart from course design and instructional design under course category. Even though measuring impact of interaction on learning outcome is complex, the role of interaction is known to be one of the core components in MOOC learning environment.

The study has discussed on the important of interaction in MOOC environment. However, the question arise is which elements or activities that can trigger interaction and become the factors of retention in using MOOC. If the goal is to solve low retention problem, then the study needs to investigate activities that can keep learners to interact and how that activities position in the MOOC design. There are many activities in MOOC but most commonly available are videos, external sources like slide notes, forum, task or assignment and quizzes or exam [44]. These activities also support content component. With advance of technology, MOOC is embedded with social media and communication tool to support interaction. The tools not only embedded within the system but also extended to external communication tools like Facebook, Twitter or MentorMob [45].

Hammick and Lee [46] study found that people who are shy perform better when online and concluded that people choose their most comfortable and preferred medium of communication during online. The finding shows that users have preference and being online give them authority to choose their mode of interaction. As any other online medium, learners in MOOC also have difference mode of interaction. According to Sun and Hsu [25], there are multiple level of interactions which can be categorized into instructional interactivity and social interactivity. Learners who preferred instructional

interaction or specifically interact with content is highly depend on activities like reading text, watching videos and slide notes uploaded by teachers. On the other hand, learners who prefer social interaction need additional medium which is social media and communication tool to interact with peers and teachers. In Abeer and Miri [44] study, the ability to communicate is found to be one of the learning competencies that affect learner's continuity in using MOOC. Thus, even though the learner prefers passive learning method like reading text or watching video, participate in social interaction is an advantage.

Element of technologies that can encourage this transition also need to be investigated. Learners who prefer learner-content interaction non-verbal interaction depend highly on medium like text, video and notes. This type of interaction can be enhanced by embedding more interactive content or include elements of gamification [25],[47]. Also, from the review of other studies, the study noticed that the MOOC research are heading towards interactivity and gamification. Meanwhile, to encourage the social interaction, the technologies such as chat, forum, email and social media are provided to support the need. According to Salmon, Gregory [48] study, learners like to use social media tool like wiki and virtual classroom to do collaborative works or Facebook to keep up-to-date information. The learners also mentioned that their peers' presence motivate them to engage with the activities. This preference keeps them using the social media and communication tools and become highly depend on the tools. If teacher or learner are willing to go another level, rapport building is recommended. As reported by Glazier [49], she found that building rapport among learners and teachers help in improving learners' retention. Rapport building is more than mere interaction which can strength and extend relationship among them and promote better learning environment. The process can be achieved through the usage of the technology like personal message through chat or email.

To sum up, Fig. 3 depicted the arguments and discussion from previous studies on the preferred materials and medium according to the mode of interaction, and also the technologies recommended to encourage the interaction. The suggestions from previous studies shows the existence of this various and changing factors and can affect interaction in the MOOC environment. Important to note that whether each condition of the factors is bad or good has not been validated yet. Instead of ignoring certain group, consider the opportunities that the group can transit to from one to another condition. Therefore, including the component with the factor being focus in the model, ensure the designer to check the impact of the component towards the MOOC learning environment before implementing the MOOC.

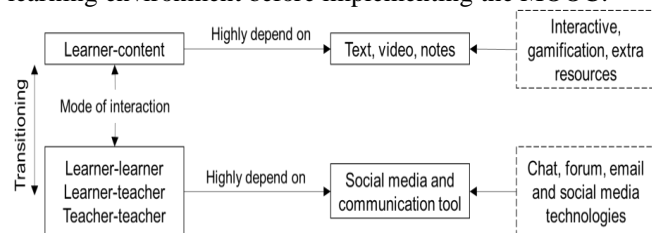


Fig. 3. Learners Need According to Their Mode of Interaction

In this section, we have concluded several important factors that can transition and the ways to increase the interaction. We also concluded that learner-assessment type of interaction in learning environment has high potential in promoting interaction and helps mitigate high dropouts issue. The next section describes a model that include the important component discussed previously and the importance of interaction among the components. The model can serve as a guideline for the MOOC improvement in future study.

#### IV. DESIGN OF THE PROPOSED MODEL

This section explained and discussed on the important components included in a developed model. The model bring connection from previous models discussed in previous section. Previous studies on MOOC design are either producing criteria or model or framework, as a guideline or benchmark to assess a course design. They developed new model or improved existing model from previous criteria or model or framework. Meanwhile, most recent studies selected few criteria or components from previous model [7], [11] which is the method chosen for this paper.

As discussed before, interaction is an important component. Interaction influence and influenced by other components. Maintaining and improving the components around interaction is important by strengthening the interaction component. The other components that associated with interaction include; the transitioning factors, the community, content, assessment and feedback, and technology infrastructure. Based on Grover, Franz [8] framework, community, content, instruction and assessment is core element for interactive learning environment while Özgür and Yurdugül [32] who proposed type of interaction with assessment, is also considered. Apart from that, [40] theory on differentiated inspired on the elaboration of the transitioning factors. The proposed model shows in Fig. 4 and each component is explained in the next subsections.

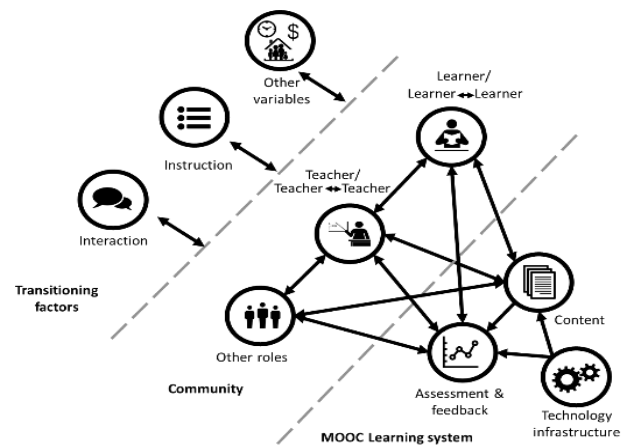


Fig 4. The Proposed Model to Support Interaction in MOOC

#### A. Transitioning Factors



Interaction as discussed in previous sections confirm its position in the model as one of the important factors. The level of interaction determines how far the learners will progress in their learning. The changing factors also include instruction component which is also important as discussed by previous studies [42]. Instruction is executed by using available tools and technologies to the fullest in order to improve learning process. Other factors such as time and space are the factors that differentiate MOOC with other type of online learning. The flexible nature gives learners control on how much time they are willing to provide for the learning process. This give challenge to the teacher on the appropriate time to evaluate the learner's performance because they are not bound with time. This is the factor that need to be considered carefully and design the possible solution. Possible solutions include embedded calendar tool for the learners to self-allocate time for each topic, or analytic that shows their progress compare to the whole class that can trigger the urgency to complete or competitiveness.

### B. Community

For community component, this section discussed the role of each component with interaction with regards of their perception on interaction from previous studies. The role of users in MOOC learning environment include teacher, learner and other roles such as faculty or institution, provider or company, technician, developer and instructional designer

#### 1) Teacher

Studies have found that interaction of learner with teacher affect learner's learning [30],[31]. This finding shows role of teacher in MOOC learning environment is undisputable. However, there is issue in supporting this learner-teacher interaction. There are several reports from teachers' perspective on the reason of lack of presence in MOOC. Studies like Ghazali and Nordin [50] mentioned that there are some teachers who are busy for other commitment. Thus, perceive MOOC as more for aided medium and not priority. In applying new learning technology like MOOC in case for blended learning, lesson could also be learned from traditional online learning such as study from Su, Bonk [19]. From an interview with group of teachers, she found that several teachers are hesitated to use technologies and activities that they are not familiar and prefer to stay with traditional ways face-to-face. This shows teacher preference and learning style affect the usage. For all the issues, there must be a solution to encourage teachers' interaction. Several solutions include help assistant tool to assist teacher with technology difficulties. The tool enable teacher to contact technical team by simple message prompt or live chat. If log in to MOOC course is challenge enough, a reminder tools can be provided. The tool like follow or subscribe button and automatic email can inform the teachers on any update of learners' responds from activities like forum. This solution looks promising as it had successfully implemented and reported by Gregori, Martínez [51] study.

#### 2) Learner

Like teacher, learners who are participating in MOOC

require motivation. This is because, to achieve higher level of learning, they need to have "interest, goals, value and control belief and efficacy" in interacting with content, peers and teachers [52]. Study from Nordin [41] found that more than half of the learners chose that they could not complete MOOC without sufficient assistance which shows they need guide and support to initiate any kind of interaction in MOOC. Meanwhile Guàrdia [53] listed interaction as one of the important components considered by learner when designing MOOC.

#### 3) Other Roles

Apart from the two important roles learner and teacher, there are other roles in community who become the backbone of the MOOC. The other roles include faculty or institution, provider or company, technician, developer and instructional designer. Faculty and institution play important role as the top management who can influences the direction of the whole unit such as whether to invest on new technology, giving points or rewards for teacher, or approve the granted credit for learner's grades. Their order also affects teacher's motivation in conducting the course to become more active by increasing interaction. Instructional designer or learning designer responsible in carrying the principles of learning into plan [54]. They need to interact with teacher and their content to understand the requirements and match with assessment. A study [55] quoted a stakeholder saying that in order to improve the quality of engagement, MOOC need to involve both learner and teacher. Thus, their roles which linked with teacher and learners are needed and indirectly improves the online interaction.

### C. Content

Content is important part that support knowledge creation. There are many opinions on the type of content preferred during the learning process in MOOC. In term of videos, several studies [48], [56] reported that the learners preferred the video materials like live video and animation. This is an advantage because video is the main resources in MOOC compare to other type of online learning which focus on slide notes or text. Apart from that, course content found to show significant contributor to perceive effectiveness which affect retention [13].

### D. Assessment and Feedback

One component that is less emphasis from earlier studies is interaction with assessment. This is due to the evolving technologies where advance learning analytic is only possible these recent years. The availability of data and technologies make the research and development for analytic more matured and the application is extended. Özgür and Yurdugül [32] study has inspired and complement existing model. The explanation for this learner-assessment interaction has been discussed in Section III, B. The usefulness of assessment for teacher is well known since before. The report generated evolved from printed report of statistic to a dashboard that give visual and informative analytic result. Teacher is able





to know the current progress of learner and can predicts their next action or score. Nowadays, analytic is also available for learner. The widely used embedded tool for learner is progress bar which tell the learner how far they are in achieving their goals. The tools encourage and motivate community to increase their interaction with the MOOC course.

### E. Technology Infrastructure

When the face-to-face interaction is not available, teacher have to rely heavily on technology and infrastructure. Technologies that are known to encourage more interaction is the element of interactivity and gamification. Other than that, social media technology also plays important part. For example, Ripiye study [57] found that with the tools and technologies used prior course started, influenced the interaction that will occur in the MOOC learning environment. Meanwhile, as feedback is important while using these social media tools, an intelligent agent can also be utilized to help monitoring and promote interaction [58]. Therefore, technologies play vital part in shaping the interaction and influence learners and teachers to revisit the MOOC.

### V. CONCLUSION

The roles of interaction in each dimension of MOOC learning environment has been presented in this paper through the discussion of the design for the model proposed. The limitation of this study includes that the designed is based from review of previous studies and experience in MOOC. However, the study has contributed additional insights on the component of online interaction that need to be considered in MOOC learning environment, especially interaction with assessment and consideration on transitioning factors. Challenges in implementing the proposed model include the applicability of the model to be implemented in blended learning where learners already accustomed with existing institution online learning. Moreover, granting credit according to activities need to be considered. Several areas that can be investigated by future studies include investigating more on the case studies which reported successful MOOC by exploring what type of interaction and activities that contribute to the success.

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