MOOC Student Learning Analytics For Automotive Technology Programme In Vocational College

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Abstract. This study aims to study the analysis of how students learning and see what they do in their Massive Open Online Course in the learning of Automotive Technology Course at Technical and Vocational Education Training institutions. This study used analytics tools, data and reports as part of an educational endeavor. At the beginning of each learning session, all students will be able to participate in this course. The participation of students enrolled in this large-scale course makes it challenging to help students individually achieve their learning objectives. Through the analytical features offered by the MOOC platform, it has made it easier for course coordinators and educators to view student learning activities in the online supplementary restraint system (SRS) course conducted through the MOOC. The findings of student learning analytics found that there are several types of learners and the tendency to follow learning by competency unit in online learning using open learning. Therefore, in this study, the analytical assessment of TVET student learning is used in achieving TVET course learning objectives. The use of learning analysis among TVET students can be used to observe interest and achievement in each unit of competency and identify students at risk during their learning process by analyzing student engagement on the page. By analyzing these interactions, learning analytics has the potential to provide predictive insights about future challenges. These predictions are used to evaluate the adaptability of the content presentation and improve the performance of the learning TVET MOOC process in the future.

1. Introduction

These days, big data and data analytics are both hot topics in the world of technical and vocational education [1]. Big Data is an explosion of information in tandem with the growth of the mobile device use the ecosystem with fast processing capabilities, high-speed Internet access, and mature data storage technology. The development of the Big Data phenomenon is also closely related to the production of a different variety, in large volumes and at high velocities of data. It can drive the growth of innovations to educator [2] and provide opportunities for educational institutions [3], industry and government agencies to improve the quality of services, otherwise introducing new services that have never appeared before. Big data analytics consists of the process of examining, cleaning, changing, and modeling data to find useful information for making decisions. Here, big data analytics can be seen as a support application in supporting a decision through the information generated [4]. This is because the information acts as evidence of something involved in the decision to make. Big data analytics is also a combination of skills in the use of information technology...
techniques, such as appropriate programming languages, to analyze data and art in understanding the resulting information. Also, it can be formulated and translated into visual forms that can help the user make a decision.

The previous student learning analytics research has generally analyzed the effects of learning by providing results from collecting and analyzing the data that affect learning. However, there are several studies on the types of analysis of student learning that are commonly performed in the e-learning environment [5] and the types of learning behavior data that are useful for students and teachers [6]. However, these data are only for public education institutions, and there is very little data on student learning analytics students for technical and vocational education institutions (TVET) especially for automotive technology programs. This study aims to explore vocational student learning styles and learning activities that can be used in data analysis learning to measure student literacy [7] in Supplementary Restain System (SRS) and system diagnostics tools. Specific research questions are as follows: 1) What are the types of students in a technical and vocational education training (TVET) student online learning the course? 2) What competencies and content appear most often in student learning, which determines their online learning? , and 3) What are the learning activities that better explained and predicted the students' learning outcomes? The results of this study are expected to provide significant guidelines in the research on learning analytics such as vocational student learning instructional design [8], analytics modeling, and Improve MOOC dashboard adequately evaluated by target users [9].

2. Overview
Learner interactions in the online education environment such as logging for virtual learning management systems [10] leave many of our media use or digital traces containing information including individual interests, social groups, behaviors, and location. This huge amount of aggregate data that is sourced from as many students as possible is known as Education Data Mining (EDM). The International Education Data Mining Association states that EDM [11] is an emerging discipline, concerned with developing methods for exploring the unique and increasingly large-scale data that come from educational settings and using those methods to better understand learners and the settings which they learn in [12]. Some agreed that EDM is a new discipline based on the Data Mining (DM) grounds. It means that the baseline is composed of models, tasks, methods, and algorithms. A researcher may want to explore data to find out descriptive patterns and predictions that characterize learners' behaviors and achievements. Moreover, domain knowledge content, assessments, educational functionalities, and applications [13]. The collection, measurement, analysis and reporting of data about learners and their contexts, for purposes of discovering patterns, understanding and optimizing learning and the environments in which it occurs is known as Learning Analytics[14][15].

2.1. Educational Data Mining in Technical And Vocational Education Training (TVET)
In Malaysia, to empower and improve TVET, a big record data will be developed by all ministries on the TVET empowerment cabinet committee. This data is expected to assist in the collection of data on demand from the industry to plan labor market [16], employment projections or to focus on critical areas. The participation of these various government agencies is expected to expand and empower TVET campaigns at the national level while providing TVET standing with other professional fields. Analytical data on student learning for general courses, niche courses, and long-life learning courses are readily available as most universities and educational institutions offer these courses online. Online service course providers should provide services accessible to all students by ensuring access to these services using all types of devices, easy-to-find, and accessible databases, and recommend content relevant to individual needs based on learning pattern analysis [17].
2.2. Student Learning Analytics

Student learning analytics in Technical and Vocational Education Training (TVET) related to educational data mining is the process of measuring, collecting, analyzing, and reporting on data about students and learners [18]. Once analyzed, the data can help course coordinator and subject matter expert better understand learning and optimize the teaching environment accordingly [19]. The intelligent data provided from learning analytics can help predict and advise on the behaviour of TVET students [20], either in an entire class or individually. The ultimate goal is to use the real-time data provided by learning analytics to encourage better teaching and learning and lead to more positive outcomes [21].

3. Method

To evaluate the analytical learning of vocational students, a MOOC for SRS courses was developed using the Design and Development Research (DDR) process [22]. This MOOC has been through the analysis phase up to the evaluation phase according to the ADDIE approach [23]. The design of this study was to invite all students using letters to educational institutions, email, and social media. Students are informed that the course will be held from May to the end of November. The Supplementary Restraint System (SRS) online course through this MOOC is a free course offered to all students. Once the course begins, students of all ages, from different locations, educational institutions, academic backgrounds, economic backgrounds and socio-cultural backgrounds, can all learn together in this course [24] through connectivism [25]. Student learning through MOOCs in the classroom or in workshops can be done using a desktop computer, phone or tablet but easier by using m-learning [26]. The course coordinator and the instructor will find out how many students have enrolled in the course, enrollment date, completion date, comment, and kudos.

Throughout the course, over 24 weeks, course coordinators and teachers can access data on student learning activities by looking at the student administrator icon. The MOOC platform will display all information about students individually [27]. An analysis is a process of adding acumen to data using algorithms. It is based on a set of mathematical and statistical algorithms known as machine learning techniques.

![Figure 1. MOOC Learning Outcomes review process](image)

This course is to look at the achievement of students' knowledge through the cognitive domain, students' practical skills through the psychomotor domain, and students' attitude and value skills [7] while operating the SRS on vehicles. Learning outcomes of students aspired by the course coordinator and subject matter expert will be included in the analysis until the course evaluation stage.
Figure 2. MOOC course quality criteria

The next MOOC content review process is to review whether it meets the criteria or does not meet the features set by the Openlearning.com design team. Among the criteria required in reliable MOOC are high-quality learning outcomes, module, learning activities, content, and resources. Any content and module that has exceeded the specified criteria will be marked as achieved, and if it does not exceed the specified criteria will be marked as not achieved. The instruments and modules used in this study comply with National Occupational Skills Standard (NOSS) face-to-face learning modules issued by the Department of Skills Malaysia (DSD) and Vocational College Standard Curriculum (KSKV). This document has been prepared according to competency units so that students can more easily follow the learning process [28].

4. Results
This study indicates that there are several types of students in technical and vocational education training (TVET) who attend online SRS courses, as in MOOC [29]. These groups of students have accomplished all learning activities and undergone a few domains in the content standard, which are knowledge, applied skills, and attitude. Their accomplishment has explained the learning outcomes sets earlier.

They are which content standard is the student most interested in learning, which of the following knowledge, applied skills, and attitude is the standard of learning that most students complete and which are learning activities that can explain the course learning outcomes of the students that are obtained correctly[30].

4.1. Type of TVET student in Online Learning
There are five types of students identified in this online course based on the Phil classification [31].

Figure 3. MOOC Lurkers student

Lurkers student is a person who lurks inside MOOC but does not participate [32]. However, they do not carry any kind assessments of knowledge assessments or practical work assessments that have been included in the MOOC by the course coordinator or subject matter expert, as shown in figure 3.
Figure 4. MOOC active student

Figure 4 shows active students are students who plan to take courses through the MOOC; they attended lectures from the beginning of the study to the last session, completed homework, interacted with other students, and completed all assessment forms. The highest number of students in this group received certificates because they had completed the course [33].

Figure 5. MOOC passive student

Passive participants are students who use every course material, watch lecture videos, complete all the quizzes, and participate in homework and course projects provided by teachers or subject matter experts. However, they do not interact with students or peers or with the other partner. There is no interaction was occurred that shown in figure 5.

Figure 6. MOOC non-completers student

Non-completers student is a group of students who cannot complete online learning [34]. The majority of students tend to fall into this category. Figure 6 shows that they have access to MOOCs course material to help them learn and succeed in the course. Mostly, the student tries to use the resources of the course but is unable to complete the entire course.
In the Observer students category, they enrolled for the course. They signed in and explored the course competency unit. However, observer students, as shown in figure 7, do not carry out any kind of assessment other than viewing the video of the activities contained in the content of the study [35].

This MOOC platform provides an overview of student progress shows in figure 8. The coordinator or subject matter expert can observe several things, such as the date of this class starts, and the current cohort of students. Another is the type of student enrollment for the free or paid class, the number of students who have participated in this course, the number of comments in this class, and the frequency of activity done in this course.

The coordinator or subject matter expert observe student's involvement in the class whether the student is a lurker student, active student, non-active student, non-completer student and observer student by looking at the course completed as shown in figure 9. The MOOC platform also provides the convenience of emailing selected students. The reminder will include the student's progress bar and a link back to the course so that they can continue with the activities.
Figure 10 shows the next features that facilitate the coordinator or subject matter expert in the MOOC platform that provides an analysis of student learning daily. Throughout the month, admin can observe student engagement data and the usage patterns of the developed SRS MOOC.

The course coordinator and subject matter expert can view analytical analysis for comments and questions found during the class, as shown in figure 11. The MOOC platform also provides a likes view of each comment posted.

| Page                           | % of students viewed | % of students completed | Views | Comments | Average Time spent on Page | Last Active |
|--------------------------------|----------------------|-------------------------|-------|----------|---------------------------|-------------|
| Keterangan Kurikulum           | 93.1                 | 13.79                   | 123   | 3        | 1.14 minutes              | 14 days ago |
| Maka Ummah                    | 47.38                | 17.24                   | 25    | 0        | 46 seconds                | 4 months ago|
| Perakihan Seri (SS)           | 27.02                | 16.17                   | 21    | 0        | 2.14 hours                | 6 months ago|
| Seni Perakihan                | 27.92                | 29.69                   | 21    | 0        | 2.14 hours                | 6 months ago|
| Bahan Pengantar Bimbit (BBA)  | 21.02                | 22.31                   | 16    | 0        | 2.14 hours                | 6 months ago|
| Course Feed                   | 27.69                | 2.61                    | 16    | 0        | .03 Second                | 6 years ago |
| Masyarakat Sosial Terkini     | 26.51                | 18.23                   | 10    | 6        | 2.14 hours                | 9 months ago|

Figure 11. Student Comments Over Time

Figure 12. Page Engagement
Page Engagement as shown in figure 12, tells pages that are always accessible to MOOC students/users. Learning habits of vocational students while using MOOC can be seen. From the course description to the last learning activity, the SRS installation guide indicates which course coordinator and subject matter expert competency most students have access to, as well as the percentage of students viewing pages that have been developed. They also can observe the percentage of students who have completed the page developed and the number of comments uploaded on each page that has been developed.

4.2. Standard competencies and content appear often
There are six competencies in the course offered to students throughout the course from the beginning to the end of the semester

| Competency No. | Students viewed (%) | Students Completed (%) | Comments |
|----------------|---------------------|------------------------|----------|
| 1              | 32.54               | 35.70                  | 1344     |
| 2              | 33.83               | 34.32                  | 774      |
| 3              | 34.32               | 32.03                  | 1057     |
| 4              | 30.06               | 33.02                  | 854      |
| 5              | 28.31               | 33.16                  | 578      |
| 6              | 30.29               | 31.27                  | 535      |

The findings in table 1 show that most students are more likely to be interested in learning in competency three, where 34.32% of the total MOOC students have seen this competency. Competency 1 shows that 35.70% of students have completed, which remarks 1344 comments.

4.3. Student learning activities
There are two discussion rooms, knowledge assessment, practical assessment and problem solving provided by the course coordinator and subject matter expert for students to complete during the course. Each activity represents student learning outcomes within the National Occupational Skills Standard (NOSS).

| Learning Activity          | Students viewed (%) | Students Completed (%) | Comments |
|---------------------------|---------------------|------------------------|----------|
| Alpha Discussion Room     | 28.89               | 26.42                  | 174      |
| Beta Discussion Room      | 25.43               | 32.59                  | 167      |
| Knowledge Assessment 1    | 29.14               | 32.10                  | 228      |
| Knowledge Assessment 2    | 27.65               | 31.85                  | 186      |
| Practical Assessment      | 27.16               | 34.07                  | 190      |
| Problem Solving           | 32.59               | 31.36                  | 105      |

The findings show that most students are more likely to solve the problems in this MOOC of 32.59%. The practical assessment shows that 34.07% of students have completed practical assessment through MOOCs and comments made by students during knowledge assessment on learning activity of 228 comments were shown in table 2. Student learning tools used in this study still do not have additional mechanisms or questionnaires to provide students’ general background characteristics, socioeconomic status, ethnicity, computer or mobile devices literacy, and so forth [36].
5. Discussion
This study aimed to explore student learning analytic analysis of vocational students participating in online learning activities through MOOC. Therefore, the purpose is to answer the following questions:
1. What competencies and content appear most often in student learning, which determines their online learning?
2. What are the learning activities that better explained and predicted the students’ learning outcomes?

The findings confirm that the most common learning competency related to the student learning concept of the supplemental restraint system is the setup scan tool, of which 35.70% of the students completed the competency. Next is the second most frequently used learning competency for students is the SRS airbag scan tool, with a percentage of students who have completed the competency of 34.32%. The third most frequently used learning competency of the students is 33.16%, which replaces the impact sensor. The fourth learning competency that most students complete is the third learning competency replace airbag module & clock spring. The second most competent student completed was the seat belt & pre-tensioner competency of 33.02%, and the lowest student competency was the sixth competency, which provided 31.27% SRS diagnostic installation & report.

Another interesting topic for discussion in the analytical exploration of student learning is the relationship between MOOC design and students' most accessible pages. Based on expert consensus results, the complete course description should be provided to the user so that it is easy to get all the information about the course followed by the highest percentage seen by 91.60%, viewed by 1545 users, and received 658 user comments. In this study, the pages that most students did not see were the Course Coordinator, where only 13.33% saw who the supervisor was and the instructor who taught in the course. In a nutshell, the pages that were interested most among users in this MOOC are service tool page (SRS) with 40.74% of users completed, 39.75% of students completed, 599 views, and 458 comments. Meanwhile, the page least viewed by students is preparing scan tools with only 29.38% viewers, 38.52% of students completed, 137 views and 205 comments. Students may be less likely to view this page because they are familiar with the automotive scan tool in other courses.

Among the two discussion rooms provided to students, the alpha discussion room recorded a student percentage of 28.89%. One of the factors that contributed to the high number of students viewed is that the alpha discussion room. It is designed to produce graphs and text that are more user-friendly during the learning process using MOOC compared to the beta discussion room that uses text only. Between knowledge assessment and practical assessment, the number most viewed by students is the knowledge assessment that has shown an increase of 1.23% from the practical assessment, and the number of students completed showing knowledge assessment has shown a decrease of 2.71% from the assessment of skills.

6. Conclusion
This study has highlighted that student analytics learning analysis examining data obtained from the supplementary restraint system (SRS) courses implemented through the Massive Open Course (MOOC). It has provided feedback to course coordinators or instructors and may change their teaching style in the classroom or during the workshop. This student's learning data is derived from courses conducted through an analytical process to systematically evaluated assessments from beginning to end. Analytical learning provides some opportunities for students to study in vocational education that can improve content and course quality. It also reduces dropout rates and increases students’ performance, to identify and promote success factors, as well as to understand students’ pathways leading to skills competency and allocate costs efficiently, which in future work we will take into consideration more indicators.
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