

Exploring TVET Higher Education Towards Learning Analytics in Malaysia

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Abstract

Higher education institutions that offer Technical and Vocational Educational Training (TVET) are fully capable of providing tertiary education and training as well as a route to successful careers. To prepare students to work effectively in a skilled trade, TVET higher education places a strong emphasis on technical, vocational and occupational education and training. With the emergence of rapid revolution industries and new educational learning styles, Learning Analytics (LA) have evolved to solve the TVET higher education teaching and learning process. A few researchers have combined earlier data to give an overview of LA concerns in higher education including in TVET. A thorough literature analysis was done to offer an overview of the advantages of employing LA in TVET higher education. Students, instructors, and institutions are three groups that receive the advantages of LA. Although LA is a novelty, TVET higher education stakeholders still need to learn more about the benefits associated with its usage in TVET higher education. A comprehensive overview offers an integrative report on the advantages of LA so that all parties involved in TVET higher education can use LA more successfully to enhance teaching and learning.

Keywords: Learning Analytics; TVET; Higher Education; Big data

1.0 Introduction

Industry Revolution (IR) 4.0 has produced new added value by integrating information and communication including cloud computing, artificial intelligence, big data, data science and the Internet of Things. The educational model that was initially created to address the needs of IR 4.0 has evolved. It is moving away from time-based learning and norm-based assessments to proficiency-based learning and criteria-based tests (Reigeluth & Karnopp, 2013). Furthermore, the traditional passive and teacher-directed students are being replaced by active and self-supervised students (Reigeluth & Karnopp, 2013). According to Lee et al. (2018), this shift has given rise to novel circumstances like personalized instruction, student behaviour analysis and alternative evaluation methods.

In recent years, with the introduction of new technologies into Malaysia's higher education system, including TVET the view of the learning process has improved. The growth of technology usage and the internet in modern society has considerably increased the amount of data acquired from technology. Many of our daily actions and behaviours are recorded by computers, which enables the collection of a vast amount of data. A significant source for education, marketing, advertising and other uses is the information that has been gathered. Similar resources exist to gather enormous volumes of data in the sphere of education (Siemens & Baker, 2012). The necessity for education and training methods, which have been created over many centuries with the rise of internet resources, to remain relevant for the Y and Z generations is one of the most fundamental shifts being considered in the world today. The arrangement in which educators are active in the classroom and students are passive has become impossible to maintain. Nowadays, information is available everywhere and is no longer the exclusive means of information dissemination in the modern world. Instead of acting as a wise man, the educator should act as a mediator. Therefore, LA was brought in as the newest technology and it has become more important in the teaching and learning process.

1.1 Literature Review

1.1.1 TVET Higher Education in Malaysia

TVET higher education offers youth the expertise and abilities needed in the workplace. In Malaysia, there are more than 1,000 TVET institutes, 506 of them being governmental institutions. Public institutions of higher education, such as polytechnics, community colleges, vocational colleges, and other institutions, have the capacity to accommodate approximately 230,000 students (Aaliyahmad, 2020). Students who participate in TVET higher education will be given the practical skills necessary to become skilled workers prepared for the workplace. As seen by the abundance of recent graduates in Malaysia, it is increasingly clear that academic credentials are not the end of job choices. Vocational education and training (VET) is an important part of lifelong learning systems that equip individuals with specific job-related knowledge, skills, and competencies (European Commission, 2015). VET aims to enhance the vocational competence of the population, improve the workplace, meet the specific skill demands of the labour market, promote entrepreneurship, and support lifelong learning and professional development (Finnish National Agency for Education, 2017).

According to Rasul et al. (2015), to address the current demand-supply imbalance in several industries, particularly those driving economic transformation, Malaysia needs highly trained human resources. The Malaysian government has recognized the TVET sector as the primary means of providing highly skilled human resources and driving the country's economy towards becoming a high-income nation. Even though the study acknowledges that the TVET transformation programmes have been used to improve the sector over time, it is very important that the major stakeholders' governance problems are systematically fixed so that the delivery and operating systems can be improved.

1.1.2 Big Data

Data analytics and big data are currently taking over the domains of technical and vocational education. According to Mazin et al. (2020), big data is the term for the information blitz that has accompanied the expansion of the mobile devices' ecosystem, which comprises swift processing power, blazing-fast Internet access and well-established data storage technologies. The development of data of a new kind in vast quantities and at rapid rates is another aspect that directly affects how the big data phenomenon has evolved. Hashim et al. (2019) said it can spur the development of educational innovations and present opportunities for businesses, government agencies and educational institutions.

Big data is also used to define the vast amount of information generated by students as they learn (Vasilis et al., 2016). Big data has three primary applications in the teaching and learning process, which include forecasting, analysing student behaviour, and evaluating academic performance. These data-driven insights can provide educators with a more accurate and precise assessment of their student's educational progress and help identify any potential issues that need to be addressed. The data gathered and evaluated, in the opinion of the learners, aids in the identification of pertinent problems and improves students' learning processes, enabling them to accomplish the idea of independent learning after having a complete understanding of their beginning points as learners. From the perspective of the educator, the data produced and evaluated aids in reviewing teaching curricula and developing strategies for educators to support learners in solving real-world challenges (Abubakar et al., 2019).

1.1.3 Learning Analytics

Learning Analytics (LA) LA measures, gathers, analyses and reports data on learners and their circumstances. It also evaluates the behaviour of educational communities (Larusson & White, 2014). Online students leave behind data traces, which LA may collect from various sources and learner activities, analyse and then present to organizations, educators and students in the form of insights and visualizations. Due to the introduction of tracking, collection and data analysis techniques into the educational setting by business intelligence has a significant impact on LA growth (Bienkowskiet al., 2012).

To obtain understanding and take action on complicated issues, LA is described as using data, statistical analysis, and models that explain and predict. To improve the learning experience for students, LA uses data analysis of the students and their activities (Prakash et al., 2014). By implementing LA, higher education institutions can better understand their students and the challenges they face in their learning. This helps to improve institutional success and retain a larger and more diverse student body, which is important for the functioning of the institution, fundraising efforts, and admissions. The management of resources at academic institutions can be enhanced by focusing on student performance.

Studies on LA show that academics are interested in using it for teaching and learning in Malaysia’s higher education (Kumar & Hamid, 2017). Some studies look at the important contributions of LA at Malaysian Higher Education Institutions including TVET education, even though LA applications there are still in their infancy (Wong, 2017). The academic management has highlighted the inconsistent implementation of LA initiatives (Tasir et al.,2016). This study seeks to examine the advantages and difficulties in developing LA values to ensure the implementation of LA is successful. As an essential tool for the management and operation of public institutions in Malaysia, LA is still not frequently utilized. There is a vast quantity of information made and gathered about faculty students but mostly unclear and unexplored. Four factors should be considered while examining Chatti's LA reference model shown in Figure 1. These factors are the types of data accessible, the objective of the analysis, the analyst and beneficiaries engaged and the use of data science techniques. The Ministry of Higher Education (MOHE) suggests focusing on these four key areas to place present Malaysian public universities in the era of IR 4.0.

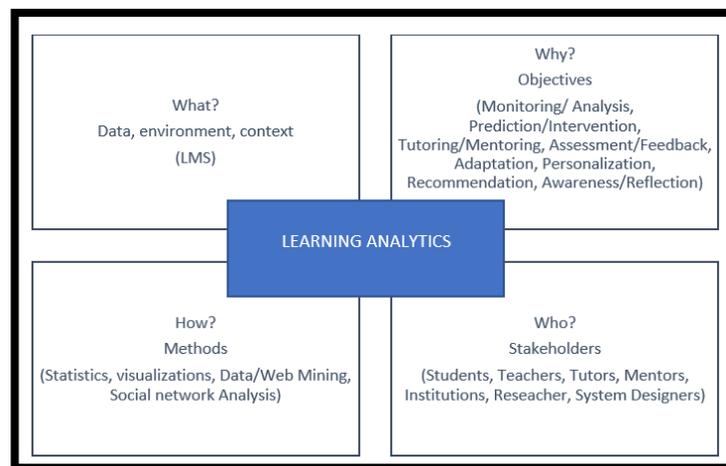


Figure 1: LA Reference Model (Chatti et al., 2014)

LA is a promising study area for tracking students' digital footprints and gaining insightful information about their learning progress. Many higher education institutions including TVET institutions are using learning management system (LMS) data and innovative analytics models to meet goals as a result of the increased data availability and the possibility that LA could have broad-reaching benefits for all stakeholders in the education field, such as students, educators, leaders and policymakers. However, the data generated by the LMS can be used to reflect on how the students engage with a system in addition to being effectively translated into relevant information. Additionally, this can comprehend better the user traits and behaviour that lead to low LMS utilization.

2.0 Methodology

The researcher used Cooper's method to conduct a literature review in response to the research problem. This systematic approach helped with defining the problem, gathering, evaluating and analyzing data, interpreting findings, and presenting the results.

2.1 Formulating The Problem

LA in TVET higher education distracts educators from identifying benefits and concerns. To effectively implement LA in TVET higher education, stakeholders in the sector require further explanation of these two crucial elements. In order to understand the benefits and challenges of LA, educators must dedicate time and effort to reviewing relevant literature. The review was guided by the following questions to address the issue:

1. What are the benefits of using LA in TVET higher education?
2. What are the challenges of using LA in TVET higher education?

2.2 Data Collection

To identify the benefits challenges of using LA in higher education for TVET, data collection aimed to locate empirical research using literature reviews published in paper research and journals since 2010. LA and approaches, LA and advantages, and LA and problems were some of the terms that were used. LA and TVET higher education were other keywords. Some of the databases that were used to look for literature were Google Scholar, the Educational Resources Information Centre (ERIC), and ResearchGate.

2.3 Data Evaluation and Analysis

40 articles were discovered using the provided approach. 37 of them concentrated on benefits, and 24 on challenges. The remaining publications did not answer the two main questions; hence they were not included in this review. Only works that directly addressed LA terminologies, advantages, and difficulties as well as assisted in addressing the two research topics were reviewed. Cooper's (1988) technique was suitable to direct a systematic review of the literature.

3.0 Result And Discussion

3.1 Benefit Of Using La In Tvet Education

After examining the literature, it has been determined that big data has many benefits for higher education, including in TVET. This involves various components of LA that analyse the educational process to improve learning outcomes. Additionally, academic analytics can be applied to alter data points using algorithms to further enhance learning. Researchers can gain valuable insights that can assist institutions, instructors, students, and researchers by studying big data. The role of reflection, lesson conclusion and course evaluation are one of this study's key findings for improving instructional design based on LA (A Shukor & Abdullah, 2019).

3.1.1 Students

One of the most beneficial things LA can do for particular students is encouraged reflection. In addition to giving a general picture of current knowledge levels, it is used to analyse students' behaviour in LMS, students' outcomes and task attainment. An LA application evaluates vocational students' knowledge based on evaluations and behaviour in learning-management systems (Krauss et al., 2016). According to Mazin et al. (2020), data on students' learning is collected from courses that were run using an

analytical process to thoroughly analyse assessments throughout. Students have some options to study in vocational education through analytical learning, which can enhance course quality and content. Additionally, it lowers dropout rates and improves student performance. It also helps to recognize and encourage success, as well as the route to skill competency and allocate expenditures effectively.

According to Darling-Hammond et al. (2019) some of the benefits of big data in the educational sector include ensuring the value and flexibility of education, assisting parents and students in finding the best educational programme and matching students with jobs. Additionally, it aids in the creation of learning models and eventually forces hands-on learning. The use of LA to students aids in college organisation and enables staff to observe student growth and understand how students advance in their studies (Ismail et al., 2021). Students' participation in discussion boards, blogs, and wiki activities, which can result in hundreds of student actions every course, might also be verified using big data analytics (Darling-Hammond et al., 2019). As research is done, unique data are acquired and analysed to recommend actions. According to studies, big data analytics can improve TVET learning and this conclusion agrees with Tobias, M.S., 2017, who claims a big data learning platform can anticipate student failure to learn with 75% accuracy.

In their study, Graf and Liu (2010) claimed that learning LA uses to analyse students' surfing habits and create user models utilising the data. LA changes students' behaviour, attitudes, aims, interests, achievements, expertise, student condition, material disparities and reviews (Premlatha et al., 2016). LA can also be utilised to help students develop their ability to control their emotions (Wong et al., 2019). Examining student behaviours that influence achievement and identifying student behaviours connected to success is another way that teaching analytics contribute to education (Castellanos et al., 2017). The key area of study for LA is looking at student behaviour. For instance, Tempelaar et al. (2015) told that learning stories, styles, motivation, engagement, and cultural variations have significant impacts on the acquisition of mathematical and statistical knowledge. When we take into account the primary activities like clicks or things presented, information on the analysis of student behaviour and identification of achievement-affecting behaviours helps identify students in danger of failing courses and who need more support (Siemens & Long, 2011).

Using LA to identify who may drop out and improve learning results will benefit all students (Carter et al., 2017). LA offers a classic assessment alternative. Wolff et al. (2013) found that traditional evaluation and LA accurately predicted blended learning achievement. Agudo-Peregrina et al. (2014) found that active participation is a significant factor in achieving academic success in online courses. The study also found that interactions with peers and educators occur before interactions with evaluation tools. Other research supports the idea that LA has the potential to be an alternative assessment method.

3.1.2 Educators

Big data analysis can be utilized by educators to enhance curriculum development in the education system. One example of this is the usage of curricular data mapping (Armayer & Leonard, 2010). By analysing big data, educators can identify gaps in learning and understanding and then make necessary changes to the curriculum. Educators can also engage in educational strategic planning to ensure that the learning curriculum is designed to meet the needs of students, thus maximizing their potential for learning. As a result, the curriculum is improved (Avella et al., 2016).

According to Gedrimiene et al. (2019) technology advancements and ongoing institutional student monitoring may not inevitably result in improved student performance. Institutional planning should focus on meaningful learning opportunities and student-centred, value-based pedagogical methods, using data only as needed. These researchers also said LA might be utilised to aid educators' professional development without them having to leave the classroom, saving time and money in the process. Educators can test the effectiveness of various teaching techniques, resources, and strategies with varied student populations (Hansen & Wasson, 2016). The use of LA in education aids in developing a thorough understanding of the entire teaching and learning process to guide decisions. Using LA, educators may track and forecast student performance, spot problems and prepare interventions to support problematic students.

The significant benefit of big data enables educators and institutions to evaluate student learning outcomes during the teaching and learning process and decide how to improve student performance (Bhardwaj & Pal, 2011). Educators can improve their teaching methods by understanding how students interact with technological resources such as e-learning and mobile learning (Hung & Zhang, 2012). In addition, can reveal the level of determination in the learning process, learning behaviour, and its impact on adaptive learning (DiCerbo, 2014). By utilizing this data, educators can identify ways to enhance student academic performance and analyse the implications on learner outcomes (Avella et al., 2016). As a result, LA provides educators with the flexibility to evaluate various types of knowledge and modify the curriculum accordingly.

LA could be used in education to estimate costs associated with completing a programme such as a diploma or a degree, identify unrecognised school projects and optimise resources (Mustapha et al., 2021). Like Coursera, many online portals have used analytics to expand and improve their business practices (Darling-Hammond et al., 2019). However, by keeping track of the money spent on instructional materials, educators can evaluate each student's progress report and can moreover help to adapt the teaching environment to the requirements of the students.

The outcome also showed that teaching strategy analysis using big data is beneficial. This claims to support Li et al. (2020) assertion big data in education aims to help educators in developing lesson plans and analysing

the data they have gathered about their students to investigate how different parts of the educational system work, as well as to evaluate student learning outcomes and instructional strategies

Orgaz et al.(2015) said the implementation of LA offers numerous benefits for educators, as it is a data-driven approach that can guide decision-making to enhance education. Additionally, LA can assist in data analysis to generate a predictive model that can be utilized for educational data, and it can also simplify the use of affordable technology devices to process data to improve educational quality. As a result, LA is considered a critical component of modern education since it can ensure that the process of teaching and learning is aligned with the evolving needs of the school system (Hue et al., 2015) and boost students' maths performance (Lu et al., 2018). Such foresight enables educators to take proactive measures to enhance students' learning mastery. In this aspect, a teacher's first efforts might have a big impact on how well their students perform. Additionally, the anticipated outcomes may inspire students who are likely to fail or drop out to reassess their study habits (Huang & Fang, 2013). Students can assess the learning that has been implemented and its efficacy and it can also help educators reflect on their teaching strategies. This could enhance teaching and learning gradually, ensuring that learning objectives are achieved, ensuring progressive growth in students' performance and lowering the likelihood of students dropping out.

3.1.3 Institutions

The information in LA can be used by governments to improve and optimise their VET networks at the national and regional levels (Gedrimiene et al.,2019). Institutions of higher learning gather behavioural data about students to aid in the development of informed choices. It is anticipated that LA will aid in making education more efficient and successful (Greller & Drachsler, 2012). Many of the research under examination demonstrated how LA can help higher education institutions improve the way their students learn and achieve (Quadri & Shukor, 2021).

Big data analysis in education allows educational institutions to select courses that better match students' requirements and preferences. Through the analysis of enrolment and interest patterns among students in various disciplines, educational institutions can concentrate their resources on programs that will attract the greatest number of students to the most critical areas of study. For long-term enrolment planning, institutions can more correctly anticipate the number of graduates (Althubaiti & Alkhazim, 2014).

Large data sets are gathered, managed, and analysed using big data analytics to produce blueprints and other valuable information. By categorising the company's most relevant TVET and related data, its use aids educational institutions where TVET education is offered in better understanding of the information contained in the data (Mustapha et al., 2021). Big data in TVET education means being able to understand a lot of operational and management data. This is done by putting together measures meant to track

institutional progress so that future performance can be predicted, as well as issues related to research, improving education, teaching and learning techniques, and other topics (Marjani et al.,2017).

Utilizing big data can enable institutions to design a curriculum that aligns more closely with the requirements of the job market and identify potential employment opportunities for post-secondary graduates. Additionally, it can forecast the likelihood of graduates finding employment, facing unemployment, or having uncertain employment prospects (Jantawan & Tsai, 2013). By leveraging big data, stakeholders in the educational system can conduct more thorough evaluations of student career paths and determine the suitability of student learning programs for particular occupations (Kostoglou et al., 2013). Moreover, besides facilitating enhanced post-secondary and educational planning, this type of data may be beneficial to organizations as they choose whether to hire or allocate funding for graduates in a variety of fields operating in a global learning environment.

TVET higher education institutions can identify low performance and at-risk students by observing student behaviour. These goals are pursued by investigating early warning systems. With data from several online learning systems being reviewed, predictive modelling is typically used to forecast the learners' academic achievement at the end of the semester (Akçapnar et al., 2019). The usage of course signals by Purdue University permits instructors to give students feedback in real-time (Hasan et al., 2020). With the use of LA, grades, demographic information, data on LMS interactions, grade history and students' efforts are assessed.

According to Ismail et al. (2021), the application of LA in a TVET higher education enables the administration and faculty members to monitor the progress of the students as well as their rate of success. It is critical to emphasise how vital the engagement model employing LA is in supporting efficient Higher education teaching and learning. The LA model will assist numerous interested parties in streamlining the methods for monitoring and making decisions. Our objective is to create the finest model possible to improve higher education's learning capabilities. Malaysia has a decent chance of implementing LA in all learning platforms because it will increase student involvement and engagement. TVET Higher education institutions require a LA model to better understand and support their students. Additionally, the LA model aids colleges in keeping track of their student's progress and producing graduates of a higher calibre. The constraints that frequently limit the use of technology in the educational mainstream must be removed for LA to transform education.

4.0 Conclusion

This research investigated the potential benefits and challenges of utilizing big data in TVET higher education through learning analytics. Due to the lack of extensive data and various research areas, learning analytics in Malaysia's TVET higher education is still in its early stages. The availability of more data will improve learning analytics' understanding of learner behaviour, networks

and interactions. This research also indicated that learning analytics requires a deeper understanding of how to evaluate data to optimise outcomes and improve education at all levels. Performance systems can improve decision-making, identify trends and challenges and optimises resource allocation. To ensure that learning analytics meets the needs of instructors, students, and institutions throughout the educational process, education stakeholders must advance their practices, methods, and information. Learning analytics has the potential to enhance the education system and provide benefit stakeholders. However, it is a relatively new and developing field, especially in TVET higher education. This literature review outlined the benefits and challenges of using learning analytics in TVET higher education to close the gap. The aim of this review is to bridge the gap and improve the use of large datasets to optimize teaching and learning through learning analytics. In the future, how LA can be used in TVET and analyse the technology and infrastructure needed to support data collection, storage, and analysis.

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A.Othman: Writing-Original Draft Preparation; **M.A. Remli:** Validation, Supervision; **F.Ridzuan:** Validation, Writing-Reviewing and Editing; **N.A.Ismail:** Validation, Writing-Reviewing and Editing.

Conflicts Of Interest

The manuscript has not been published anywhere else and is not being considered by any other journals. All authors have authorized the review, agree with the submission, and state that they have no conflicts of interest in the work.

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