A Social Media Analytics Framework to Increase Prospective Students' Interests in STEM and TVET Education

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Abstract: Recently, the promotion of Science, technology, engineering and mathematics (STEM) education has become the highlight due to the shortage in the STEM workforce. Surprisingly, the enrolment rates in STEM degrees are still low in many countries. Social media has been identified as one of the main platforms that can help to increase prospective students' interest in STEM and also Technical and Vocational Education and Training (TVET) subjects. However, very little research has been done for the higher education institutions in Malaysia in leveraging social media and social media analytics effectively to increase the students' interests and awareness of STEM and TVET disciplines. Therefore, this paper aims to propose a framework to increase prospective students' interest in STEM and TVET using social media and big data analytics. The objectives of this study are to explore various social media applications in education and study these applications towards increasing students' interests and propose a suitable framework for Malaysian higher education institutions. The framework is proposed by following the theory synthesis methodology. Four main components of the framework have been proposed, namely social media, role model or mentoring, massive open online courses and big data analytics. Each component is significant and requires a considerable amount of time to develop. The suggested framework is anticipated to benefit higher education institutions with a significant gain of the number of students, revenues and positive reputations.

Keywords: Social media, Social media analytics, STEM, E-learning, Education

1.   Introduction

Recently, the promotion of Science, Technology, Engineering and Mathematics (STEM) education has become the highlight due to the shortage in the STEM workforce (He, Murphy, & Luo, 2016). Furthermore, the enrolment rates in STEM degrees are still reported to be low in many European countries (Achilleos, Mettouris, Yeratziotis, Papadopoulos, Pllana, Huber, & Dinnyés, 2019). These problems have resulted in the identification of social media as one of the solutions. In a higher education setting, the uses of social media for various purposes are increasing. Researchers and students used social media for communication, meetings and increasing visibility (Birkholz, Seeber, & Holmberg, 2015). Consequently, social media has become part of the daily life of university students, teaching and learning activities and integrated with the Learning Management System (LMS) (Kasuma, Saleh, Akhiar, & Ismail, 2018). The rise of social media also has changed the marketing strategies of the institutions (Irfan, Rasli, Sami, & Liaquat, 2017).

Social media has been used by international researchers to increase the students' interests and awareness on STEM and Technical and Vocational Education and Training (TVET). Researchers highly suggested that higher education institutions and the ministry of education should aggressively use social media to promote education (Irfan et al., 2017). The survey, conducted by the Malaysian Communications and Multimedia Commission (MCMC) in 2018 indicated that the younger generations in their 20`s and 30`s spent, on average between 7.3 hours to 8 hours per day online (Irfan et al., 2017). Certainly, many of them are students in universities and vocational colleges.

Facebook is one of the most popular social media platforms with 22 million Malaysian users in 2018 (Busalim, Masrom, & Binti Wan Zakaria, 2019). Furthermore, it was reported that Malaysian tend to spend more time on Facebook (Busalim et al., 2019). The English language is the first and the most used on Facebook, with around 1.1. billion users (Badache, 2019). It is followed by Spanish (310 million), Indonesian (170 million), Arabic (150 million) and Portuguese (150 million) as the languages most used on Facebook after English (Badache, 2019). Facebook has been used for an educational purpose that can accommodate communications, interaction with peers, collaborations and classroom exercises (Toker & Baturay, 2019). However, excessive Facebook use was argued to interfere with students` studying (Toker & Baturay, 2019).

Nevertheless, Twitter is one of the most popular microblogging platforms and social networking (Nalwoga Lutu, 2019). Being one of the top ten most visited websites, there were more than half-billion retweets reported per day on Twitter (Curlin, Jaković, & Miloloža, 2019). It was famous for marketing purposes where users with many followers, known as influencers were paid to tweet about products or services (Nalwoga Lutu, 2019). Recently, Twitter was regarded as one of the most important channels for information about personal and public events (Curlin et al., 2019). One of the advantages of Twitter is the ease to collect data. Twitter can be used for collecting photos data from tweets using the Twitter streaming API that happens to be near-real-time (Yanai, Okamoto, Nagano, & Horita, 2019). Twitter followers are also used to analyze social networks (Nalwoga Lutu, 2019). On the other hand, Twitter can be used to analyze users' behavior (Curlin et al., 2019).

Instagram is also one of the most popular social media platforms where more than 72% of the users are between 13 years old to 17 years old (Thomas, Chavez, Browne, & Minnis, 2020). A huge increase in the number of users (approximately 150 million) was identified in 2015 compared to in 2010 (Schaffer & Debb, 2020). Likewise, Instagram is more focused on photo and video content. Instagram has served the purpose of marketing and branding, communications, building connections and entertainment (Schaffer & Debb, 2020). It was argued that self-branding using Instagram cost less in terms of money and time (Islam, 2019).

The field of social media analytics aims to analyze social media data to gain useful information and knowledge (Stieglitz, Mirbabaie, Ross, & Neuberger, 2018). It was argued that the steps for social media analytics are often similar and replicable (Stieglitz et al., 2018). With the billions of social media users' created data in a short time (referred to as big data), social media analytics is more challenging than ever (Ghani, Hamid, Targio Hashem, & Ahmed, 2019). These data can be used to learn human behavior and

gain insights (Ghani et al., 2019). For instance, the big data from social media were applied for analytics, trend identifications, opinion mining and sentiment analysis (Katal, Wazid, & Goudar, 2013). Yet, Twitter is one of the prominent sources of social media big data with millions of generated daily tweets (Shaikh, Rangrez, Khan, & Shaikh, 2018).

The higher education institutions in Malaysia have not leveraged social media and analytics effectively to increase the students' interests and awareness of STEM and TVET disciplines. Surprisingly, if the students want to know more about STEM and TVET education in Malaysia, they will find most of the information through websites, blogs and newspapers. There is a very huge gap and opportunities for the higher education institutions and Ministry of Education to utilize social media such as Facebook, Twitter and Instagram, to disseminate important information regarding STEM and TVET disciplines. Furthermore, during this challenging time of the Covid-19 pandemic, the higher education institutions and the Ministry of Education need to provide vital information on education activities in social media to address the concern of parents, students and prospective students.

Thus, this study will propose a framework to increase prospective students' interest in STEM and TVET using social media and big data analytics. The objectives of this study are to: 1) explore various social media applications in education; 2) study these applications towards increasing students' interests; and 3) propose a framework suitable for Malaysian higher education institutions. In section 2, we present previous studies that used social media and other related platforms to increase students' interest in education. In section 3, we propose and describe a social media analytics framework for Malaysian higher education institutions, aiming to increase prospective students' interests in STEM and TVET education. In section 4, we discuss the benefits and the challenges of developing the framework. Finally, in section 5, the study is concluded.

2.   Related Work

In this section, the previous studies of social media, role modeling or mentoring and massive open online courses (MOOC) to increase students' interest in education were investigated.

2.1   Social Media

The importance of social media to promote education tourism has been reported in the literature (Irfan et al., 2017). The impact of social media usage on education promotions improves the economic and social of the nation among others. Therefore, the same impact for STEM and TVET related fields is possible to be achieved using social media promotions. It was argued that the early adopters of social media use among higher education institutions will gain an advantage (Birkholz et al., 2015).

A project known as SciChallenge European project aimed to increase the interest of pre-university students in STEM disciplines was implemented (Achilleos et al., 2019). Social media was systematically used for this purpose. The methods used were social media-aware contests and platforms that were able to attract more than 700 participants and reported to increase their STEM learning and motivation. It can be concluded that engagement activities such as contests are important to attract the younger groups.

Meanwhile, research in the Czech Republic has been conducted to analyze marketing efforts using websites and social media such as YouTube and Facebook (Ptáčkova, 2017). Twenty-three Czech higher education institutions were included. The findings indicated that marketing is very important for Czech colleges and universities to disseminate information and communicate with the younger public through the internet.

Another study on Facebook and Twitter utilization to share content such as news, papers, videos and job offers related to higher education degrees of the University of Cadiz has been conducted (Laserna & Miguel, 2018). The target was degree students. Quantitative and qualitative evaluations were conducted respectively from Facebook and Twitter analytics, and surveys. The results supported that the method of sharing content on social media can increase the students' motivation and broaden knowledge about the topics.

Likewise, research was conducted to identify the relationship between social media and academic self-concept (Liu & Gu, 2017). The study targeted 246 students in secondary school, aged 12-16 years old in China who used social media such as blogs and WeChat. It was identified that there is a significantly high positive correlation between positive social media relationships among peers and the academic self-concept and learning interest.

On the other hand, a study has investigated the enterprise social networks that promote collaboration in professional environments (Sifi, Bargaoui, & Alouane, 2017). An academic social network was proposed based on the enterprise social network principle. The research aimed to promote collaboration between students of the same institution. Several criteria were selected for grouping or clusterization of the students' information including personal information and activities history. The academic social network was named SLNet and then upgraded to SLNet 2.0.

2.2 Role Model/Mentoring

The career role models who share similar interests and demographics were argued to help inspire students to develop interests in STEM-related fields (He, Murphy, & Luo, 2016). The students will have the ambition to emulate the role models. The importance of social media for connecting with peers in professional networks has been supported (Manca & Ranieri, 2016).

Social media can act as a medium. Twitter college student users and diverse LinkedIn STEM professionals matching using a ranking algorithm based on the similarities of their demographics and interests have been proposed to promote STEM education (He et al., 2016). The results of evaluations on 2000 real college students indicated that the algorithm can accurately match both parties. However, the effectiveness of the algorithm in increasing the students' interests in STEM-related fields has not been mentioned.

A study has investigated the e-mentoring impact on students' persistence in a STEM major (Wolfe & Gregg, 2015). The study also explored how underrepresented students, who are facing barriers to campus-based education use social media tools such as virtual platforms. The study suggested an e-mentoring program where mentor/mentee relationships should be considered as important factors. The study demonstrated that the utilization of social media tools help higher education institutions cater to the underrepresented students.

2.3 MOOC

MOOC was recorded to be used from 2008 (Corbeil, Khan, & Corbeil, 2018). Through MOOCs and social media platforms, users can share, track, and search for information on their specific interests (Su, Ding, Lue, Lai, & Su, 2017). Taiwanese higher education institutions focused on MOOCs to increase students` interests in education (Hsieh, 2019). The strategy applied was to increase institution revenues by offering MOOCs with the lowest cost using social media. The Quality Function Deployment Method of House of Quality (QFD-HOQ) model of qualitative analysis was applied to build the Most Valuable Social-media Technology MOOCs Interdisciplinary Course Evaluation Model (MVSTMICEM) The objectives were to identify how social media technology can be used to increase school student`s self-studying interdisciplinary interest, how to attract corporate employees, and how to reduce course costs. MOOC can keep the students engaged in studying, but not necessarily increase the prospective students' awareness of STEM subjects. Therefore, MOOC should be complemented with an awareness campaign.

A study among 269 Malaysian university students to identify their preferences of social media and learning management systems (LMS) for an academic purpose has been conducted (Kasuma et al., 2018). The study used questionnaires. Interestingly, the results indicated that the students preferred both social media and LMS but have a higher preference for social media. Notably, the interesting discovery was that the contents shared with them are more important than the design of the social media or LMS platform. Therefore, it was suggested that both platforms are suitable for formal-informal learning in a higher education institution.

The MOOC can be integrated with big data analytics to identify students` interactions, unknown correlations, and hidden patterns. The outcome of the study is the recommendation of the students` learning behavior (Su et al., 2017).

3. The Social Media Analytics Framework

The proposed framework is to increase prospective students' interest in STEM and TVET education. The framework is proposed by following the theory synthesis methodology outlined in (Jaakkola, 2020). The framework is proposed by the integration of multiple methods namely social media, role model/mentoring, MOOC and data analytics. The target of the framework audiences is prospective students in Malaysia who might enroll in STEM and TVET courses in the higher education institutions in Malaysia. The architecture of the social media framework is depicted in Figure 1. There are four primary components of the framework namely social media, role model/mentoring, MOOC and big data analytics.

3.1 Social Media

Three main social media are selected as the main platform to build awareness and share content with the audiences. The reason why Facebook, Twitter and Instagram are chosen is that: 1) all of these social media have many users; 2) the majority of the prospective students (teenagers and young adults) use these social media; and 3) these social media platforms provide insight functions that can be used for data analytics (Busalim et al., 2019; Curlin et al., 2019; Ghani et al., 2019; Irfan et al., 2017; Katal et al., 2013; Nalwoga Lutu, 2019; Schaffer & Debb, 2020; Shaikh et al., 2018; Stieglitz et al., 2018; Thomas et al., 2020; Yanai et al., 2019). Different types of content will be used including news, information, activities and updates in the format of texts, images, audios and videos to increase the awareness of prospective students of the benefits of STEM and TVET subjects. According to the sales funnel, awareness will lead to interests (Meyer, 2019).
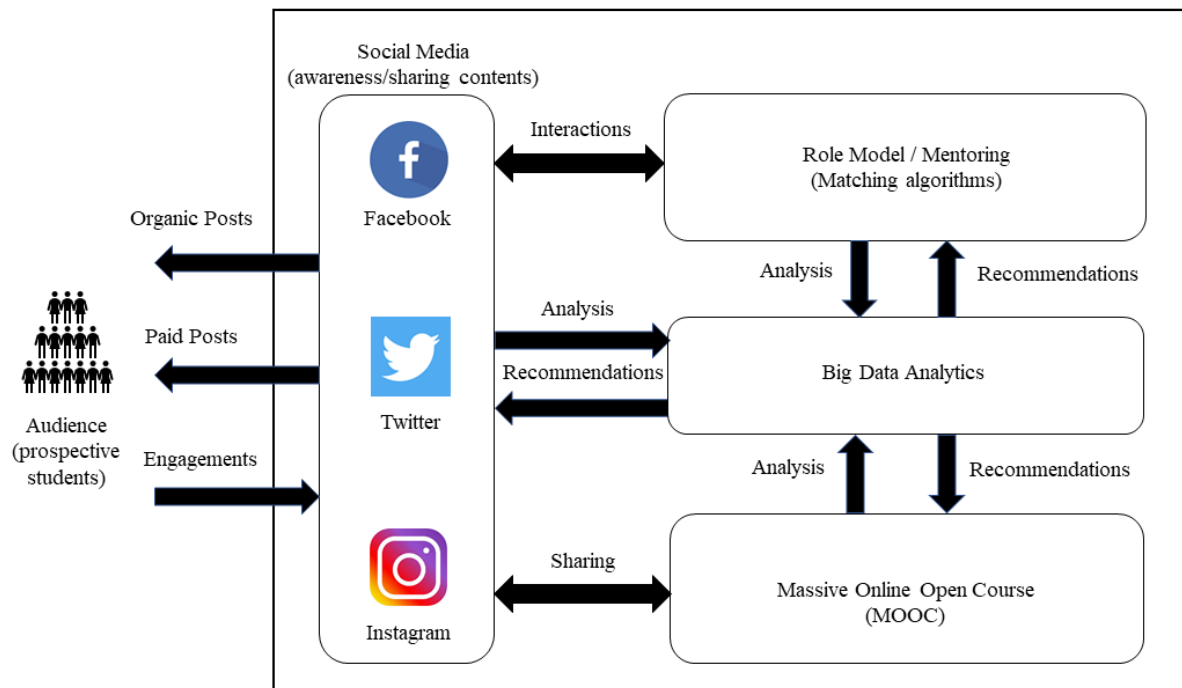

Figure 1. The social media analytics framework to increase student interests' in STEM and TVET

education.

Both organic posting and paid posting will be used. The engagements of the audience will be measured. Personal information of the audience will be collected including the name, email, phone number, gender, age, education level and occupations. The collected data will be sent to big data analytics components for analysis.

3.2   Role Model / Mentoring

Prospective students who show interest in the STEM and TVET subjects will be matched with a role model or mentor using a matching algorithm. Their interactions could be using suitable social media such as LinkedIn (He et al., 2016). The role model or mentor could be the lecturers or successful alumni from STEM and TVET courses of higher educational institutions. The reason is to increase the interests of the prospective students when they have a role model or mentor that was successful in the areas. Personal information such as gender, age, education level and occupations that were collected earlier will be used for the matching. The matching algorithm will be developed as part of the whole framework.

3.3   MOOC

MOOCs will be used and integrated with social media platforms. Since the main target of the framework are prospective students, the MOOC contents will cover only fundamental aspects of STEM and TVET education, aiming to increase the interests and basic knowledge of the prospective students. Engaging activities such as quizzes and contests can be used, and basic certification of completion can be provided to students who completed each course (Achilleos et al., 2019). The students will be encouraged to share the results, certificates and course contents to their social media to increase the interests of their peers and other prospective students.

3.4   Big Data Analytics

A big data analytics component is an enhanced component of the framework. Big data analytics can apply and integrate many areas such as autonomous protocols, sentiment analysis, data mining and machine learning (M. H. Adnan, Hassan, & Aziz, 2016; M. H. M. Adnan, Husain, & Rashid, 2011). The findings from the component will be used to recommend: 1) suitable posting, type of contents to the target audiences and marketing strategy; 2) suitable role model or mentor of the prospective students; and 3) type of courses suitable to the prospective students based on their personal information or behavior.

4.   Discussion

In this section, the benefits and challenges of the proposed framework are discussed thoroughly. Firstly, the main benefits are the potential increase in prospective students' interest in STEM and TVET education using an effective social media marketing strategy (Meyer, 2019). Secondly, the potential increase in interest may increase the number of students enrolled in STEM and TVET courses in higher education institutions. Thirdly, it will potentially increase the revenues of the institutions. Fourthly, the data of the prospective students can be collected (Busalim et al., 2019; Curlin et al., 2019; Ghani et al., 2019; Irfan et al., 2017; Katal et al., 2013; Nalwoga Lutu, 2019; Schaffer & Debb, 2020; Shaikh et al., 2018; Stieglitz et al., 2018; Thomas et al., 2020; Yanai et al., 2019). The data can be used for classifications and the prediction of prospective students for an effective marketing strategy. Fifthly, the positive reputation of the institution can be improved.

The challenges to developing an effective social media framework lie in choosing the right audiences, post types, contents and marketing strategy. This is the reason why the big data analytics

component is important. However, before the effective selections or the right audiences, posts, contents and marketing strategy can be made, the framework will need to go through a series of trial and error tests.

Although the proposed framework might look as simple as it is, each component of the framework is significant and requires a considerable amount of time to develop. The role model or mentoring platform, the big data analytics and MOOC cover wide areas that span across information technology, software development, marketing, data science, artificial intelligence and many more potential areas in STEM and TVET (Adnan, Hassan, & Zulkefli, 2020).

5.   Conclusion

The paper investigates previous studies involving social media, role modeling or mentoring and massive open online courses (MOOC) to increase students' interest in education. As a result, a conceptual framework to increase prospective students' interest in STEM and TVET using social media and big data analytics has been proposed. Such a framework is one of the ways forward for higher education institutions to increase student enrolment in STEM and TVET programs and its revenues.

6.   Acknowledgement

7.   References

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