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Social Media on Students' Interestedness in STEM Careers

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Abstract:
This study investigates the role of social media in predicting students' choice in STEM career. Students' choice of a particular career is influenced by personal and contextual factors. However, studies on the effect of social media on STEM careers are negligible. A survey was conducted on 330 secondary school students aged 13-17. The outcomes showed that (i) level of social media use in science learning and the (ii) level of students' interestedness moderate. It was also found that changes in the level of using social media in science lessons might lead to equivalent changes in affinity toward STEM careers. This study provides evidence that the usage of social can result in a significant impact on students' affinity toward STEM careers. Thus, efforts to increase teachers' skills in conducting educational activities that use the social platform are necessary. Hence, teachers would be convinced of the effectiveness of the application of online social networking applications in STEM learning.

Keywords: interest, social platform, social media in learning, secondary school students, STEM careers.

关于学生对干职业兴趣的社交媒体

摘要：
本研究调查社交媒体在预测学生选择干职业中的作用。学生对特定职业的选择受个人和背景因素的影响。然而，关于社交媒体对干职业影响的研究可以忽略不计。对 330 名 13-17 岁的中学生进行了调查。结果表明，（i）科学学习中社交媒体的使用水平和（ii）学生的兴趣水平适中。研究还发现，在科学课程中使用社交媒体的水平变化可能会导致对干职业的亲和力发生相应变化。这项研究提供的证据表明，社交的使用会对学生对干职业的亲和力产生重大影响。因此，有必要努力提高教师使用社交平台开展教育活动的技能。因此，教师会相信在线社交网络应用程序在干学习中的有效性。

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关键词：兴趣、社交平台、学习中的社交媒体、中学生、干职业。

1. Introduction

Innovations based on Science, Technology, Engineering and Mathematics (STEM) are central to propelling a nation's economic success. However, students participating in STEM fields are declining despite policies advocating more students in STEM. Thus, student retention in STEM remains an urgent priority in many countries, including Malaysia.

Many variables that influence the decision of a student to choose a STEM major and later on, joining a STEM career have been identified in research findings. In students' advancement through the STEM pipeline, interest has been recognized and highlighted as among one of the most influential factors (Akosah-Twumasi et al., 2018; Shahali et al., 2019; Young et al., 2017). The aforementioned studies also highlighted that interest in the field is augmented through effective teaching and learning techniques. The probability of pursuing a STEM profession is 5.4 times more likely for those who have an affinity toward skills related to technical and science (Blotnicky et al., 2018).

Early interest was established as a predictor of students who obtained a STEM degree from college (Tai et al., 2006). Career development has been thought by researchers to begin at the school level (Lent et al., 1994; Trusty, 2004). Research also indicates that shifts in interest at this stage of secondary school have a long-lasting impact compared to any other phase of one's life (Anderman & Maehr, 1994). DeBacker and Nelson (1999) argued that awareness and interest in STEM-related subjects during the early stage of a student's life may predict imminent participation in STEM-related learning and/or possible career ambitions and interests. Herbert and Stipek (2005) further argued that students will probably pursue STEM-related careers when they secure confidence in STEM learning.

Many factors have been theorized, such as Social Cognitive Career Theory (SCCT), in explaining interest and STEM careers. According to Lent et al. (1994), thoughts, beliefs, and environmental factors affect career interests and success (Petersen, 2014). However, much of the current research focusing on variables of SCCT is related to the psychological components of the person, such as self-efficacy with fewer considerations placed on the role of school-related factors such as classroom culture, instructional techniques and teachers' teaching strategies (Crisp et al., 2009; Lent et al., 2016).

2. Literature Review

Many studies suggested that media plays a significant role in effective teaching techniques and strategies that can enhance students' learning. Media in teaching and learning encompasses the physical and social-media form. Physical media includes both reading and multimedia materials (books, magazines radio and television) (Chukwuemeka, 2013). STEM learning kits for construction or practical work are also forms of learning media. However, social media (such as *WhatsApp, Facebook, YouTube, Telegram, Instagram, Twitter* and *LinkedIn*, as well as open social activities such as blogging) are used for learning to allow and enable ease of interaction with peers in and outside the classroom (Aini et al., 2020). In particular, students from other schools who are learning the same topic as well as subject specialists can leverage on social media platforms. In the context of STEM education, social media platforms allow for various activities that cover, among others, sharing of news, interests and discussions so that students and teachers can keep abreast with the rapid changes in STEM research and education. Thus, social media in STEM teaching and learning is a gateway to knowledge. Platforms such as *Youtube*, *Instagram* and various websites are prime examples of sites where students can conveniently search for information. This increased access to knowledge not only benefits students but also the educators as it helps them acquire the latest modalities of science learning to improve teaching in their classrooms.

Today, social media is not only a privileged option but has also become a fundamental aspect of human life. There is a high probability that almost every person over the age of 13 would have an account on at least one of the popular social networks such as *Facebook* or *Instagram*. Pardo (2013) revealed in her study that a child in America occupies their time to have fun on social media approximately amounting to an average of 7-8 hours a day. Additionally, she claimed that the child is also capable of conducting multi-tasking activities such as listening to music, sharing information on *Facebook* and sending messages to *Twitter* all at the same time on the various media they employ. She also pointed out that these forms of experience are a significant part of how people learn (Pardo, 2013). In a similar vein, Kirschner and Karpinski (2010) found that 46% of the young generations draw upon the Web to assist them with their homework or assignments. They also argued that networking through the social media platforms allows students to easily communicate with their peers and teachers, thus making social media beneficial if proper planning is put in place in the use of these applications to help students learn.

Various studies have reported the effect of physical media in enhancing students' learning; however, research on social media in education at the school level is still scarce and limited. Nevertheless, there are studies involving students at the tertiary level that have reported a positive impact of social media on interest in STEM (Borge et al., 2020). In the study by Al-Rahmi et al. (2015), students' academic performance had a positive effect when they utilized social media platforms as the technology allows interaction among their peers and with their supervisors in addition to

experiencing collaborative learning. Their finding is also supported by Nazir and Brouwer's (2019) study; the researchers concluded that *Facebook* as a teaching tool had a positive impact on learning if the learning activities are integrated in a course design constructively. Similarly, He et al. (2016), who used the social media *Twitter* and *LinkedIn* to match students with STEM professionals, found that university students would be prone to a STEM career if they can interact with professionals who are considered role models to them. Generally, these studies demonstrated that social media platforms in STEM learning positively affect students' interest in STEM career.

Social media and its role in education are undeniable. However, studies on its effectiveness on interest in STEM and eventually in STEM careers, particularly among adolescents, are lacking. Moreover, research shows that changes in interest during secondary school have the longest lasting effect compared to any other period of one's life. Thus, this study examines the impact of social media applications (as a tool in science or STEM lessons) on students' interest in STEM careers. Social media platforms involved in the study included *WhatsApp, Facebook, YouTube, Telegram, Instagram, Twitter* and *LinkedIn.* Thus, the research question: What is the association between social media use in learning of STEM-related subjects with students' interest in STEM careers?

3. Research Methodology

3.1. Research Design and Sample

This study employed a survey design, and the sample included secondary school students in an urban school. The school was selected from among schools that have teachers - who have been exposed in using social media to assist students learning. The teachers used social media as a platform to monitor progress and to assist students with their questions while solving problem-based/project-based activities. The sample of this study was 330 secondary school students (aged 13-17). Stratified random sampling was used to randomly select respondents in each age group with the same gender ratio. From the 330 students, 165 (50.0%) are male while the other 165 (50.0%) are female.

3.2. The Survey Instrument

To assess the occurrence of students using social media for learning STEM subjects, the students in this study had to state how often social media is used (*WhatsApp, Facebook, YouTube, Telegram, Instagram, Twitter* and *LinkedIn*) for science learning activities based on a Five-Point Likert scale (1 - never to 5 - very frequent). Meanwhile, to measure the level of interest in STEM career, a Career Interest Questionnaire adapted from Tyler-Wood et al. (2010). The face validity of the instrument was reviewed by a panel of experts comprising a teacher who received the Outstanding Teacher of Science and Mathematics award and two lecturers from the Institute of Teacher Education. Sixty secondary school students were involved in the pilot study. Items in the questionnaire reflect the constructs measured as shown through the Cronbach's alpha coefficient value of more than 0.7 (Table 1) indicating that the reliability value of the instrument was considered high. The survey was administered by the first author, after obtaining permission from the State Education Office. Further permission was obtained from the school principal to administer the questionnaire. The researcher who administered the questionnaire also provided an explanation to the students on the objectives of the study and how to respond to the questionnaire.

3.3. Data Analysis

The students' nature of using social media for science lessons and their interest in STEM careers was analyzed descriptively. The interpretation of the mean score in this study was divided into three, namely high level (mean score value of 3.67–5.00), medium level (mean score value of 2.34–3.66) and low level (mean score value of 0–2.33). Additionally, inferential statistical analysis, Structural Equation Modelling (SEM), employed the SPSS AMOS software to identify the association between the usage of social platform apps in science learning and the students' interest in STEM careers. Each item was tested for its normality assumption. The skewness index (SI) and the kurtosis index (KI) were determined. The SI values ranged from -0.311 to 1.080 and by taking the absolute values, thus met the suggested standard of 3 (Kline, 2011). The KI values were between -1.001 and 0.903. The KI values, taking its absolute value, were less than 10 (Kline, 2011).

Before the SEM analysis was carried out, validity and reliability procedures were performed on the items. Two types of validity (content and construct) were employed for content soundness. Two STEM education experts validated each item. Construct validity was based on the Exploratory (EFA) and Confirmatory (CFA) Factor Analyses (Tables 1 and 2).

The significant p-value explains the causal directional correlation and the regression weight (β) explains its strength. The r^2 value helps explain how the model varies from the data observed. All analyses were performed using Amos 22.

3.4. Convergent and Discriminant Validity

All the items were significantly reflective of the construct, $p < 0.001$ (Table 1). All loadings with values ranged from 0.65 to 0.93, which was beyond the required criterion of 0.050 (Anderson & Gerbing, 1988). The AVE scores above the 0.50 (at two decimal place) - suggesting that the variance due to the construct exceeds the variance due to errors related to measurement. The values of at least 0.60 of composite reliability of Bagozzi and Yi (1988) suggest adequate convergent validity for the study was met.

Table 1. Convergent validity for the construct: interest in STEM careers

No. of items	Item loadings[a]	AVE	CR	Cronbach's alpha
12	0.65 - 0.93	0.450	0.804	0.729

[a] $p < 0.001$

The correlation between the constructs (Table 2) suggests that the variables differed from each other.

Table 2. Examination for discriminant validity

Construct	Social media in science learning	Interest in STEM careers
Social media in science learning	-	0.275
Interest in STEM careers	0.275	-

4. Results

The descriptive analysis (Table 3) on the usage of social media was found to be moderate (mean = 2.86, σ = 0.96). Students' interest in STEM careers was also moderate (mean = 3.13, σ = 0.43).

Table 3. Descriptive analysis (N = 330)

Construct	Minimum	Maximum	Mean	σ
Social media in science learning	2.00	5.00	2.86	0.96
Interest in STEM careers	2.17	4.25	3.13	0.43

On the effect of social media on interest in STEM careers used in science learning and teaching, an SEM model was constructed. Model fit indices found were as follows: χ^2 = 2.795, χ^2/df = 1.398, TLI = 0.994, CFI = 0.998, IFI = 0.998, RMSEA = 0.035. The indices indicate that the proposed model (Figure 1) matches the observed data. The squared multiple correlations indicated that 1.4% of the variation in STEM careers with respect to interest was explained by the level of application of social media in science learning and teaching. Additionally, the beta value (β) = 0.117 demonstrates a significant effect of social media usage on students' interest.

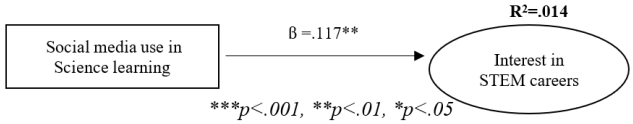

Figure 1. Path coefficients of the hypothesized model

The robust empirical endorsement for the hypothesized model, as shown in Figure 1, indicates that social media usage can have a significant effect despite the relatively small contribution. Thus, fostering the use of social media in science learning is imperative. Additionally, as social media is common to the students, the acceptance of social media as an innovative teaching and learning strategy will be seamless. The predictive effect found in this study is congruent with previous findings involving tertiary level students (Baier et al., 2016; Blotnicky et al., 2018; Burwell-Woo et al., 2015; Lent et al., 2016) indicating that social media usage in learning processes encourages students to pursue in STEM, thus leading students to choose STEM careers.

5. Discussion

The results showed that the level of social media use in science learning and the level of students' interestedness are moderate. It was also found that regularity of using social media in science lessons might lead to equivalent changes in students' affinity toward STEM careers. The evidence also showed that the use of social results had a significant impact on students' interestedness toward STEM careers.

The positive path between the use of social media and career interest suggests that teachers should systematically integrate social media into learning activities. Additionally, teachers should also know how to employ relevant techniques to maneuver online learning activities toward the target learning objectives and nothing else. As stated by Kirschner and Karpinski (2010), since their birth, the younger generation has shared an ambiguous connection with technology, leading them to multitasking seamlessly on these platforms. Additionally, these social media platforms enable students to network, collaborate and connect with their peers, family members and teachers who share similar interests in education (Pardo, 2013). These forms of experience are beginning to become an essential aspect of learning in this digital age (Pardo, 2013). As remarked by Rideout (2012), students tend to spend much time on social media; in other words, students are focusing more time on 'entertainment media' than the time they spend in school each year. Thus, teachers should leverage on this fact by utilizing social media as learning tools in their teaching as it could help to nurture students to choose STEM as a career.

Moreover, the positive path between social media use in science learning and interest in STEM also implies that professional development programs for teachers should put the focus on developing teachers' capability to conduct science lessons that use social media to spur students' inclination toward STEM learning and STEM careers. As argued by Melese et al. (2021), teachers should be mindful of the negative impact of social media platforms and be convinced of the effectiveness of social media in STEM learning so that they would be more willing to adopt it in their STEM teaching. Accordingly, the appropriate training program for teachers will increase their confidence to teach STEM using social online networking applications. Utilizing social platforms for STEM teaching and learning enables teachers to develop students' creative thinking, problem solving, and teamwork that are part of the 21st century skills (Sukarmin et al., 2021). Rideout (2012) argued that an

individual might spend enormous time on the internet as social media operates 24 h a day and every day. The time that is spent on the social platform is definitely phenomenal, unlike the limited hours spent at school or in full-time jobs. In light of this, media content developers should collaborate with STEM stakeholders to develop quality materials. Previous studies such as Zarzour et al. (2020) serve as a guide to provide effective teaching and learning using tools of social media. Additionally, government should implement policies that determine effectiveness and accountability of learning science and STEM-related subjects through a social platform in and outside of school hours.

6. Conclusion

This study examined the effect of social media tools on STEM teaching and promoting students to choose STEM careers. The findings show that employing social media in learning activities has a small but significant effect. These findings imply that social media can be helpful in the delivery of science courses, and it should be further promoted. One practical implication is to provide professional development programs to science teachers, in particular, social media tools that integrate STEM-related careers while learning the STEM content. The small variance percentage contributing to the interest in STEM careers implies that a more concerted effort in integrating social media tools in the teaching of STEM subjects is necessary and should also use the tools toward promoting STEM careers too. Our findings also support the predictive capabilities of the projected model that could assist as a hypothetical basis for upcoming researchers concerned in researching STEM learning activities. Further research should explore how and why the social media helps trigger their interest in STEM learning and careers. Accordingly, a qualitative approach by using interviews could provide better insights and a deeper understanding of the phenomenon.

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Authors' Contributions

Chong, W.W.: conceptualization, data collection, writing; Mohd Shahali, E.H: conceptualization, analysis, editing; Chan, M.Y: conceptualization, editing; Halim, L.: conceptualization, analysis, supervision, funding.

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