

FROM SOCIAL INFLUENCE TO AI ADOPTION IN STEM EDUCATION: THE MEDIATING ROLE OF INTENTION

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Abstract. The adoption of artificial intelligence (AI) is pivotal in enhancing teaching and learning STEM in secondary education. However, the adoption rate among teacher in Sabah remains inconsistent. Therefore, the main objective of this study is to examine the mediating role of behavioural intention in the relationship between social influence and AI usage for STEM education, using Structural Equation Modelling (SEM). This study employs a quantitative approach, utilizing a cross-sectional survey to gather data from 345 secondary school science teacher in Sabah. Finding indicated that behavioral intention fully mediates the relationship between social influence and AI usage. The mediating role suggests that SI alone will not shape AI usage, rather BI is needed to encourage teachers to use this technology. This research contributes to the existing literature by highlighting the importance of behavioral intention as a mediating factor and contributes practical implications for stakeholders aiming to optimize technology adoption initiatives among science teacher in Sabah.

Keywords: *social influence, behavioral intention, artificial intelligence, mediating role, STEM education*

Introduction

The adoption of artificial intelligence (AI) in STEM education has become essential for enhancing personalized learning, enriching learning resources and increases students' engagement through various interactive simulation (Li et al., 2024). Apart from that, AI fosters real-world problem-solving, and equips students with future-ready skills, in line with the current needs (Park et al., 2023). Based on the Future of Jobs Report published by the World Economic Forum, it is predicted that by 2030, there will be a change in the direction of global employment trends through the impact of automation and digitalization. It is forecasted that the human workforce will be replaced by the use of automation technology and artificial intelligence (AI) in the future (Guan et al., 2025). In this regard, the education system in Malaysia is now moving towards the use of AI at all levels of education. Through the implementation of the Digital Education Policy, all teachers are urged to apply AI in all subjects, including STEM education. However, despite their growing availability, the adoption rate of this technology remains inconsistent.

Therefore, understanding the factors influencing the use of AI is critical to ensuring their effective implementation. Among these factors, social influence, has been identified as one of a significant determinant factor based on technology acceptance model, Unified Theory of Acceptance and Use of Technology (UTAUT). According to Shakib Kotamjani et al. (2023), social influence is a significant factor in shaping behavioral intention, whereas behavioral intention subsequently drive actual usage. In addition, behavioral intention plays a crucial role in mediating the relationship between social influence and AI usage, which posits that an individual's intention to perform a behavior is a key predictor of whether they will follow through with that behavior

(Wardat et al., 2023), Although social influence and behavioral intention are widely recognized as critical factors in technology adoption, research on how these constructs interact remains limited, especially in the context of STEM education in Sabah. To address this gap, this study aims to investigate how behavioral intention mediates the relationship between social influence and AI usage in STEM education among secondary science teachers in Sabah. In addition, this present study provides an explanation of whether social influence alone can encourage science teachers to use AI or vice versa. By doing so, the study will contribute to more effective strategies for promoting the use of AI in STEM education, and indirectly improve STEM and science teaching and learning in Sabah.

Literature review

Social influence

Referring to the original UTAUT model, social influence is defined as an individual's perception of the extent to which the practices, opinions, and responses of individuals around them who are considered important can influence their own actions (Venkatesh et al., 2003). Social influence is referred to as the extent to which the views of close individuals such as colleagues have a specific influence on an individual's perception of accepting a change. Accordingly, social influence involves an interpersonal agreement or agreement between an individual and others in the same social environment. There are three main factors that form social influence, namely social conformity, compliance and obedience. Although these three factors are often considered the same, in reality, all of these factors differ in terms of the source of influence involved (Venkatesh et al., 2003). Meanwhile, according to Wardat et al. (2023), social influence refers as an individual feels that important others believe that they should try new innovations, such as using the latest technology. Influential individuals may include superiors, colleagues, close family, or close friends (Shakib Kotamjani et al., 2023). Accordingly, administrators are the most important party in shaping teachers' behavioral intentions in accepting a reform in education or vice versa. In the previous study, emphasized the role of the principal as the main entity directly involved in implementing the planned program, in line with the need to implement an educational policy or policy that must be complied with.

From another perspective, colleagues are an important entity in the development and direction of an individual's career. Thus, the process of technology diffusion occurs very aggressively in a community due to the influence of close friends or colleagues. In the context of technology use, colleagues are not only teachers who teach in the same school, but also involve teachers who share the same perceptions, practices or backgrounds. This means that all science teachers, regardless of school location, are assumed to have a significant influence in the formation of behavioral intentions to use the technology. In addition to administrators and colleagues, social influence also comes from the implementation of educational policies. This is because all teachers are required to comply with established educational policies. For example, in the context of education in Malaysia, teachers are encouraged to use innovative technologies such as artificial intelligence in line with the implementation of the Digital Education Policy (DPD).

Social influence and behavioral intention

Based on the UTAUT model, social influences are identified as main predictor of behavioral intention for technology adoption (Li et al., 2024; Songkram and Osuwan, 2022). Generally, in the context of education, social influence includes administrators, colleagues, students and educational policies (Chahal and Rani, 2022). According to Wardat et al. (2023), social influence plays an important role in shaping a teacher's behavioral intention to use technology. The finding of Chahal and Rani (2022) confirm that greater social influence is obtained from the support and encouragement of administrators. However, this statement contradicts the opinion of Xue and Wang (2022) who confirm that colleagues provide a more dominant influence than administrators. The role of colleagues in shaping behavioral intentions is also discussed comprehensively in the study by Chahal and Ran (2022). The justification is that the researcher assumes that colleagues who have used a technology can easily share and spread the benefits and methods of using the technology to other colleagues. This situation is able to attract individuals to also try the technology. Consistent with the opinion of Wardat et al. (2023), the resarcher argue that the role of colleagues in influencing behavioral intentions is more dominant than that of administrators because the use of technology among colleagues is able to create an environment that supports or cultivates a technology.

Behavioral intention and technology adoption

Kim and Kwon (2023) previous study reported the influence of behavioral intention on actual behavior in technology adoption. It was found that the stronger the behavioral intention, the higher the teacher's tendency to use the technology in teaching (Li et al., 2024). Therefore, it is predicted that the level of actual use or adoption of technology can be increased if behavioral intention increases. However, previous studies confirmed that the strength of the influence of behavioral intention on actual behavior is difference due to various factors.

AI adoption in STEM education

With the capacity for adaptation, AI has been shown to support the strengthening of problem-solving skills (Zhai and Krajcik, 2024), which is highly emphasized in STEM learning. In addition, the technology allows students to undergo dynamic and flexible learning sessions (Hallal et al., 2023). In the context of science teaching, AI tools support science learning by increasing students' ability to understand and master abstract and complex science concepts more easily and quickly (Zhai, 2024). According to Wardat et al. (2023), science concepts are mastered more easily if students are directly involved in building learning experiences. For example, AI tools have been found to provide meaningful and enjoyable learning experiences through the generation of simulation and interactive activities. These simulation activities offer opportunities to understand concepts through exploratory activities. In reality, the use of AI technology can create enjoyable learning experiences and increase students' interest in learning (Adelana et al., 2023). Through this technology, teachers can produce various simulation-assisted activities and games such as Almanack AI and Minecraft Educational Edition or simulation software such as Phet Interactive Simulations to help students master science concepts and at the same time strengthen scientific literacy. Admittedly, the element of playing while learning in simulation activities has been proven to attract interest in learning and further improve mastery of science concepts

among students. Furthermore, generative artificial intelligence applications such as Squirrel AI or Labster can be used to strengthen students' scientific skills. In addition, the use of generative artificial intelligence in science education is also significant in improving problem-solving skills among students. AI offer personalized learning, enhance teaching strategy, and conduct assessments more effectively. On this basis, AI is identified as a complementary component in enhancing the quality and effectiveness of STEM education (Park et al., 2023).

Conceptual framework

Although the Unified Theory of Acceptance and Use of Technology (UTAUT) framework has been widely used in technology acceptance studies, according to Venkatesh (2000), modifications need to be made in line with the current research context. Essentially, based on UTAUT, social influence plays a significant role in shaping the behavioral intention to use a system or technology. This intention will subsequently affect the actual behavior of using the technology. This actual behavior serves as main indicator of technology acceptance. Studies have consistently conceptualized behavioral intention as a mediator between social influence and actual behavior. It was demonstrated that social influence affects behavioral intention, which in turn directly predicts technology use (Li et al., 2024). However, research on the role of behavioral intention as a mediator has been less emphasized in discussions of technology acceptance. Therefore, in the context of this study, through UTAUT, the role of social influence as a key predictor of behavioral intention will be assessed in addition to examining the role of behavioral intention as a mediator in the relationship between social influence and actual use of AI, as shown in *Figure 1*.

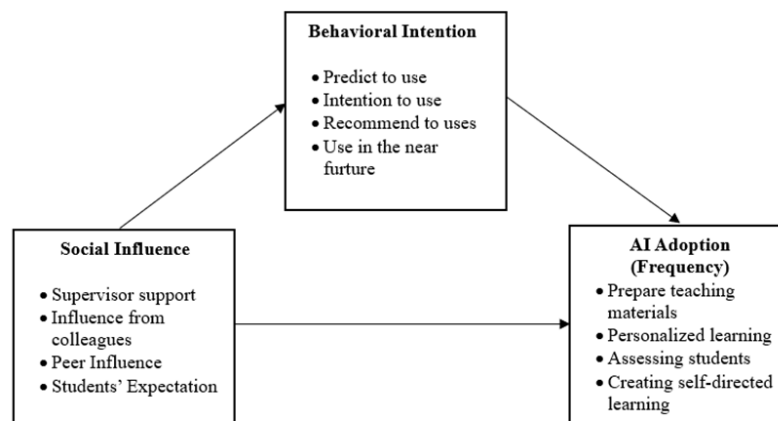


Figure 1. Conceptual framework.

Materials and Methods

The design of this study is a quantitative study using a cross-sectional survey method. In this study, the perspectives of the respondents will be collected, analyzed and interpreted accurately and comprehensively. The study population involved 1432 science teachers who teach in secondary schools in Sabah. Through the determination of the sample size of Krejcie and Morgan (1970), a total of 345 respondents were selected using proportional stratification sampling approach. The structured questionnaire was

divided into two sections. The first section gathered demographic information about the respondents, while the second section contain on the constructs of social influence, behavioral intention, and usage of AI in science teaching. The instrument was adapted from instrumen develop by An et al. (2023). In this study, the researcher used a five-point Likert scale, which was 1= Strongly Disagree (STS) to 5= Strongly Agree (SS). To ensure the validity of the instrument, content validity was established through expert reviews. Internal consistency was assessed using Cronbach's alpha, with all constructs showing reliability coefficients above 0.70, as suggested by Hair et al. (2022). Therefore, this questionnaire is assumed to have good internal stability and consistency and is ready to use. Partial Least Squares Structural Equation Modelling (PLS-SEM) was used for regression analysis, and mediation analysis is utilised to evaluate the mediating influence of behavioral intention.

Results and Discussion

Measurement model

Internal consistency reliability for a research model refers to the composite reliability (CR) value and Cronbach's alpha. In the context of this study, assessing the level of reliability through the CR value involves reading values in the range of 0 to 1. According to Hair et al. (2022), reliability is at a satisfactory level if the CR value is between 0.864 to 0.943. Therefore, in this study, the CR value accepted refers to the view of Hair et al. (2022) which is ≥ 0.700 . Apart for that, a Cronbach's alpha value > 0.70 is assumed to be sufficient and acceptable. The other important measurement of reliability showed the factors loadings for the items of three constructs is between 0.746 to 0.977. The other important measurement of reliability showed that convergent validity was acceptable because the Average Variance Extracted (AVE) was over 0.5. The results for reliability and validity along with the factors loadings for the items of all constructs are presented in *Table 1* and *Figure 2*.

Table 1. Loadings, reliability and validity.

Variable	Construct	Loadings	Cronbach's alpha	AVE	CR
Social Influences (SI)	SI1	0.977	0.919	0.807	0.943
	SI2	0.987			
	SI3	0.751			
	SI4	0.858			
Behavioral Intention (BI)	BI1	0.746	0.791	0.715	0.864
	BI2	0.782			
	BI3	0.794			
	BI4	0.813			
Actual Use (AB)	AB1	0.824	0.851	0.863	0.900
	AB2	0.756			
	AB3	0.764			
	AB4	0.969			

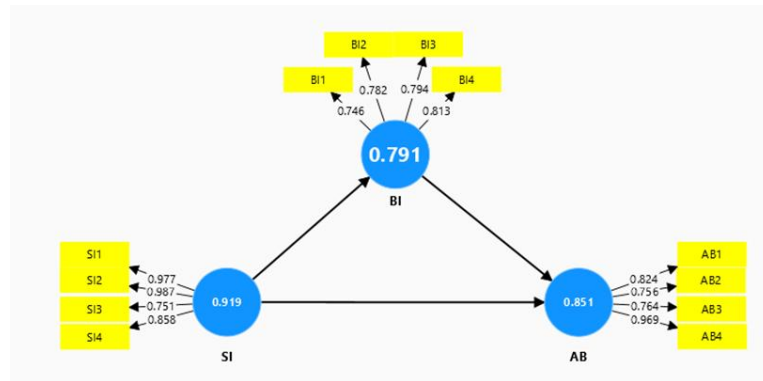


Figure 2. Measurement model.

Behavioral intention as mediator

In general, mediation analysis is conducted to test the research hypothesis, which is whether behavioral intention acts as a mediator in the relationship between social influence and actual behavior in the use of artificial intelligence among science teachers. The research findings are as shown in *Table 2*. In this study, a mediation analysis was conducted to examine the mediating effect of behavioral intention by comparing the direct and indirect effects. The results of the analysis are illustrated in *Figure 3*. As shown in *Table 2* and *Figure 3*, social influence does not have any direct effect ($\beta = -0.005$, $p > 0.05$) on the adoption of generative artificial intelligence. However, the findings of this study demonstrate that behavioral intention acts as a full mediator in this relationship ($\beta = 0.031$, $p < 0.05$). The findings of this study are in line with the main principle of UTAUT, where the actual use or adoption of technology only happens when there is an intention.

Table 2. Direct effect, indirect effect and total effect.

Category	Direct Effects	Indirect Effects	Total Effects	t	P values
SI -> AB	-0.005			0.150	0.881
SI -> BI	0.052	0.031	0.083	1.912	0.036

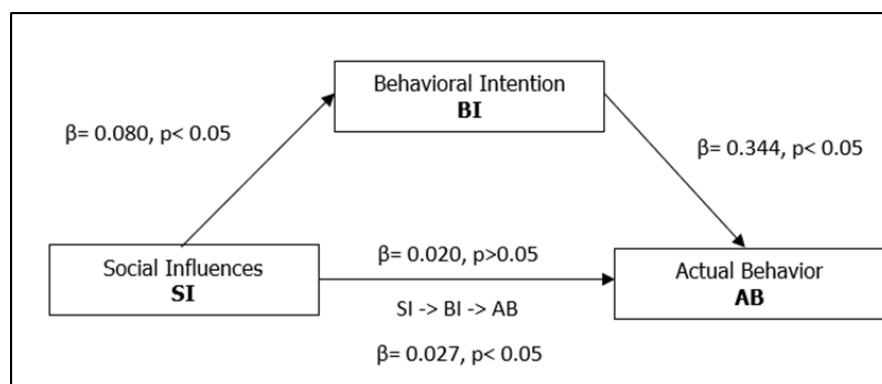


Figure 3. BI as mediator.

Behavioral intention as mediator

The study reveals a significant positive relationship between social influences and behavioral intention and behavioral intention with the actual behavior or usage of AI in STEM education. This finding supports the notion that social influence plays a role in

shaping behavior intention and at the same time users' intentions are crucial predictors of their actual behavior. This outcomeas strengthen the basic principles of UTAUT as explained in the studies An et al. (2023) and Park et al. (2023). This aligns with existing literature that highlights social influence as a critical factor in technology acceptance, particularly in educational settings where collaboration and peer support are vital (Zhai and Krajcik, 2024). However, the relationship between social influences and actual behavior was found insignificant. This means that, even though science teachers establish a positive perception that the use of the technology is fully supported by administrators and colleagues, the scenario only forms the desire or intention to use AI and does not guarantee the actual practice of using that technology in the classroom. In reality, social influence only has a positive effect on the formation of behavioral intention, not actual behavior, as discussed by Venkatesh et al. (2003). Overall, in the context of this study, based on the perceptions of science teachers in Sabah, behavioral intention is considered important because it serves as an intermediary or bridge that connects social influence with the actual behavior of using AI as a science teaching tool. Without behavioral intention, the presence of support from administrators or colleagues is meaningless. These findings fully support the basic principles of UTAUT, which emphasize the role of behavioral intention as a mediator between predictor factors and the actual behavior.

Limitation and future research direction

In this study, the respondents consisted of teachers who teach science subjects at secondary schools. Therefore, to add variation in the study findings, further studies on the use of generative artificial intelligence need to involve teachers at the primary school level. The implication is, empirically, that the findings of the further study can be used to compare the level of use of generative artificial intelligence in science teaching in Sabah. Next, in this study, there are several limitations of the study that can be suggested for future studies. First, the instrument for collecting data is through the use of questionnaires. Therefore, further studies are suggested to involve qualitative methods such as focus groups or in-depth interviews so that the study findings are more reliable and provide a real perspective on the use of artificial intelligence among science teachers. In addition, since this study uses a cross-sectional survey format, the researchers only collect data that provides a picture of the situation at that time. Therefore, as a suggestion, the survey method is conducted longitudinally so that the data is more accurate and precise. Regarding the sampling technique, as a suggestion for future studies, researchers need to avoid gatekeeper bias at the final stage of simple random sampling when selecting science teachers in each school. This procedure is important to ensure that the selected sample is not close to the appointed personnel.

Implications

This study explores the mediating effects of behavioral intention in AI usage among secondary school science teachers in Sabah. By using UTAUT model, this study offers a comprehensive understanding the role of behavioral intention as mediator. The empirical results significantly support the UTAUT model, affirming the significance role social influence as predictor in shaping intention. Recent study confirms that social influences mostly come from colleagues. In this context, colleagues are not only

teachers who teach in the same school, but also involve teachers who share the same perceptions, practices or backgrounds are an important entity in the development and direction of an individual's career. This means that all science teachers, regardless of school location, are assumed to have a significant influence in the formation of behavioral intentions to use the technology. Apart from that, the findings reconfirm that without intention, the actual use of AI in science teaching remain inconsistent, even with the presence of support from administrators or colleagues. For instance, support from administrators or colleagues should be a priority in strengthening the intention to use AI, and indirectly increase the adoption of AI in STEM education..

Conclusion

Overall, based on the perceptions of science teachers in Sabah, the use of AI in science teaching can be strengthened if there is support from administrators and colleagues. Furthermore, the intention to use this technology can be increased if the use of AI is cultivated in schools. Science teachers acknowledge that without the presence of behavioral intention, the actual use of the technology remains inconsistent even in the presence of social influence. Therefore, constructive, comprehensive, and holistic actions need to be carefully planned to ensure that the use of AI in STEM education in Sabah can be appropriately enhanced through the emphasis on the role of sbehavioral intention.

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Conflict of interest

There is no conflict of interest regarding the publication of the paper in any journals.

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