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TEACHERS' TRANSFORMATIONAL LEADERSHIP AND TEACHING BEHAVIOUR IN ENHANCING SECONDARY PRIVATE SCHOOL STUDENTS' INTEREST IN SCIENCE: A MEDIATION ANALYSIS

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ABSTRACT

This research aims to examine the mediation effect of teaching behaviour in the relationship between teachers' transformational leadership practices and students' interest in science. A non-experimental quantitative approach was used, with a total of 250 students from secondary private schools in Malaysia participating voluntarily as respondents in the study. Google Form questionnaires were distributed through email for data collection. The findings indicated significant positive associations between teachers' transformational leadership practices, teaching behaviour, and students' interest in science, as revealed by correlation and regression analyses. Mediation analysis demonstrates that teachers' teaching behaviour partially mediates the relationship between transformational leadership and students' interest in science. This study emphasizes the importance of effective teaching behaviour in fostering students' interest in science, providing valuable insights for educational policymakers, school administrators, and teachers in promoting science education and improving students' academic achievement.

Keywords: *Transformational Leadership, Teaching Behaviour, Students' Interest in Science, Science Education*

INTRODUCTION

A strong interest is crucial for academic success. Interventions to enhance student interest are particularly important in educational settings where many students lack initial interest or where interest tends to decline over time (Harackiewicz et al., 2016). For example, during the transition from middle to high school, students' academic interests in STEM topics often experience a decline (Brophy, 2008). By engaging young students in science early on with exciting materials and experiences, it can instil motivation and curiosity, leading to sustained interest in sciences throughout their schooling years and equipping them with valuable problem-solving skills (Helm & Katz, 2016). Students who exhibit genuine interest in a subject are more likely to regularly attend classes, actively pay attention, actively engage in learning, enrol in additional courses, process information effectively, and ultimately achieve academic success (Hidi & Harackiewicz, 2000). The role of teaching in students' learning is crucial, encompassing

various factors such as teachers' pedagogical approach, classroom environment, and accommodating attitude towards students (Carroll et al., 2009). An ideal classroom setting should create opportunities for students to observe effective teaching practices while also allowing teachers to observe genuine learning (Hattie, 2012). Teachers' accommodating behaviours, such as displaying an open-door policy, responding to students' questions, showing empathy, being actively engaged, and acknowledging students' efforts, can have a positive impact on students' motivation and overall performance (Rashid & Zaman, 2018). When it comes to academic achievement, Fredricks, Blumenfeld, and Paris (2004) identified study habits and attitudes towards studying as two significant drivers. According to Rashid and Zaman (2018), teachers' attitudes can significantly influence students' learning abilities and performance. Teachers have multiple roles beyond just teaching, including being subject experts, promoting interest in the subject, and serving as role models for students (Bogler, Caspi, & Roccas, 2013). Students have highlighted the importance of intellectual stimulation in transformational leadership, noting that the lack of such stimulation significantly reduces their interest in the subject, while also stating that when teachers pay individual attention to them, they increase their efforts (Morton et al., 2010). Transformational leadership refers to conducts exhibited by teachers that empower and inspire others, go beyond self-interest, and instil confidence in others to achieve higher levels of functioning (Bass & Riggio, 2006). Teaching behaviour pertains to the actions, strategies, and instructional approaches employed by teachers during their classroom sessions (Hadie et al., 2019). It encompasses various elements such as enthusiasm, clarity, organization, rapport, interaction, disclosure, speech, and pacing, which have been shown to yield positive student outcomes (Rashid & Zaman, 2018). Despite the value of past research, there has been minimal comparison of multiple aspects, particularly teachers' transformational leadership practices and teaching behaviour that affect students' individual interest in science classes. According to Tsai (2015), it is noteworthy that the higher the level of passion that teacher leaders exude, the more effectively they can provide diverse opportunities for learners, deliver high-quality teaching, and consequently achieve superior learning outcomes for their students.

One of the most prominent challenges in the field of science education is the decline in motivation and interest among students, especially in empowering sciences, as substantiated by multiple studies conducted by Betsy et al. (2016), Kiemer et al. (2015), and Potvin & Hasni (2014). Extensive research conducted in countries like the USA, Australia, and New Zealand has also revealed a noticeable decrease in students' motivation during their junior high and middle school years, as reported by Woods-McConney et al. (2013). Furthermore, recent studies conducted by Plenty and Heubeck (2013) and Vedder-Weiss & Fortus (2012) have highlighted a declining trend in youths' motivation towards learning mathematics and science over time, further exacerbating the challenge faced by teachers in sustaining student interest and achievement in the subject of science. In fact, Kiemer et al. (2015) have even reported a significant drop in students' interest in STEM (Science, Technology, Engineering, and Mathematics) subjects throughout their secondary education, adding to the complexity of addressing this issue.

Private schools are managed by independent organizations and funded through tuition fees paid by students. These schools typically charge higher fees to cover superior facilities and state-of-the-art technology. The administration of private schools regulates the fees and the recruitment of teachers, with school administrators solely responsible for determining the prerequisites for becoming a teacher. While private schools are required to follow the government-approved curriculum, the mode of delivery is determined by the school board, as highlighted by SchoolAdvisor.my. in 2021. Notably, there is a pressing need for qualified and competent science teachers who can conduct lessons in English in private schools, with an increasing emphasis on effective teaching practices and student engagement. Being one of the few schools in Malaysia that offer Dual-Language Programme (DLP), particularly in the urban Klang Valley area (SchoolAdvisor.my., 2021), can be a significant advantage in attracting more parents to enroll their children in private schools. As parents always strive to provide the best education for their children, choosing a reputable school is of utmost importance, as stated by Wespieser in 2015 and Priya in 2018.

In the context of science education, it is crucial to understand the factors that influence students' interest in the subject. Previous research has highlighted the significant role of teachers' leadership practices and teaching behaviour in shaping students' interest in science. However, there is still a need to explore the relationships between these variables and the underlying mechanisms that mediate these relationships. Therefore, a quantitative study was conducted to fill this research gap, investigating the relationship between teachers' transformational leadership practices and students' interest in science in private schools in Klang Valley. This relationship will be examined both directly and indirectly, taking into consideration the potential mediating role of teachers' teaching behaviour.

This study's research objectives are as follows:

1. To analyse the relationship between teachers' transformational leadership practices, teachers' teaching behaviour and students' interest in science among Malaysian students in secondary private school.
2. To examine the mediation effect of teachers' teaching behaviour in the relationship between teachers' transformational leadership practices and students' interest in science.

Theoretical Framework

Interest development theory, as proposed by Hidi and Renninger (2006), suggests that interest is a dynamic and multifaceted psychological construct that develops over time through the interplay of personal and environmental factors. According to interest development theory, students' interest in science is influenced by their initial individual interest, which can be nurtured and developed through teachers' instructional practices, such as their teaching behaviour. The foundation of this research is grounded in the constructivist learning theory, which posits that students acquire knowledge by actively constructing it based on their present and past experiences (Fernando & Marikar, 2017; Ormrod, 2011; Resnick, 2017). It is essential for educators to grasp how students assimilate new information from both classroom and personal encounters, as emphasized by Ormrod (2011), aligning with the principles of constructivist learning theory. A deep understanding of students' backgrounds and knowledge reservoirs enables teachers to effectively implement a constructivist approach to education and learning, as proposed by Fernando & Marikar (2017) and Resnick (2017) in their constructivist learning framework. Consequently, constructivism serves as the underlying theoretical framework for this study, facilitating the adaptation of transformational teaching theory to students' learning and environmental experiences and fostering the development of innovative teaching practices that yield positive outcomes for students.

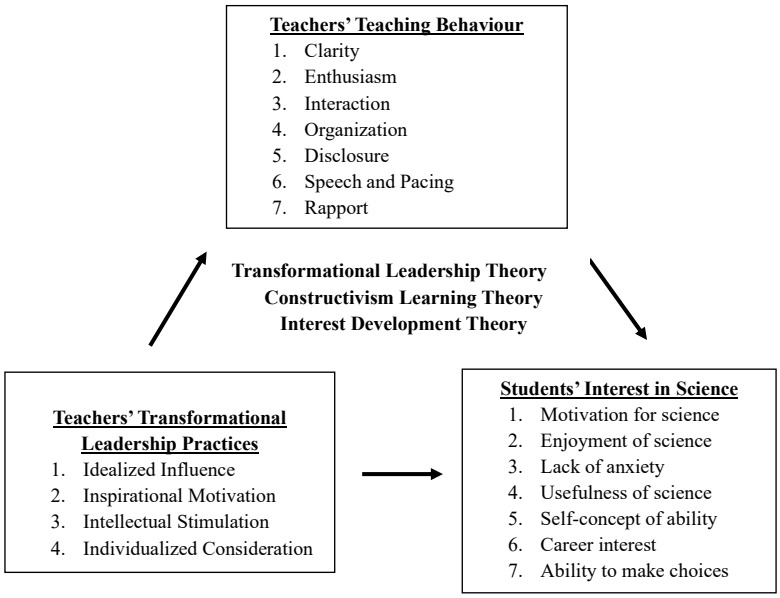

Figure 1. *The framework underpinning the study.*

*T**eachers'** Transformational Leadership, T**eachers'** Teaching Behaviour and S**tudents'** Interest*

The significance of teachers' transformational leadership practices as a crucial determinant of student learning has been widely acknowledged (Bolkan & Goodboy, 2009; Bolkan et al., 2011). Furthermore, such practices have been observed to have a positive impact on student engagement (Ko et al., 2022). When teachers display intellectually stimulating behaviours, it can foster intrinsic motivation in students, encouraging them to adopt a deep and strategic approach to their studies (Bolkan et al., 2011). Transformational leaders, including educators, serve as inspirations who motivate their followers to reach their full potential. In the context of education, transformational teachers cultivate a positive classroom environment by establishing dynamic relationships among teachers, students, and shared knowledge. This approach promotes student learning and personal growth (Slavich & Zimbardo, 2012). The principles of transformational teaching encompass various strategies, such as providing role models and mastery experiences, challenging and encouraging students, delivering personalized attention and feedback, creating experiential lessons beyond the confines of the classroom, and encouraging opportunities for improvement and reflection (Slavich & Zimbardo, 2012). These strategies significantly influence students' attitudes and interest in science. Research has demonstrated that transformational leadership in science education leads to enhanced student outcomes (Elliott & Asghar, 2014). These practices focus on meeting the needs of others rather than the leader's own needs, and they employ contemporary leadership techniques like empowerment and inspiration (Bostock, 2018), providing students with meaningful scientific exploration opportunities. As teachers exhibit qualities of transformational leadership, they become role models in the eyes of their students, resulting in heightened interest and engagement in science.

Although the importance of transformational leadership practices is widely recognized, the specific influence of these practices on students' interest in science has received limited investigation. Recent research has successfully distinguished between teacher leadership practices and the actual classroom teaching behaviour (Lai & Cheung, 2015; Ovando, 2020). Different teacher leadership practices have varying effects on teaching and learning approaches, as well as the overall effectiveness of school improvement efforts (Lai & Cheung, 2015). Some teaching practices, like planning and preparation for instruction, may be negatively affected by teacher leadership (Ovando, 2020). Therefore, it is crucial to understand that while teacher leadership practices may be related to teaching behaviour, they are not interchangeable concepts.

Teaching behaviour serves as a mediator in the research framework proposed in this study. As transformational teachers exhibit inspiring leadership practices, their teaching behaviour aligns with these practices, thereby positively influencing students' interest in science. By employing innovative instructional strategies, fostering active student engagement, and creating a supportive learning environment, teachers can stimulate students' curiosity, enhance their motivation, and ultimately increase their interest in active participation and involvement in the class (Kamran et al., 2022). Research has shown that teachers who adopt student-centered instructional practices, encourage critical thinking and problem-solving, and provide opportunities for hands-on experiments and discussion-based instruction tend to foster greater science learning outcomes among their students (Granger et al., 2012). Additionally, teachers' classroom management abilities have an impact on teacher-student interactions and the amount of academic learning time. Research indicates that effective teaching requires the use of classroom management skills. Well-organized classrooms are more conducive to learning and have fewer disruptions, hence can significantly impact students' interest and outcomes (Fricke et al., 2012). In another study, teacher interpersonal behaviours were found to be positively correlated with students' efficacy for learning science, value for learning science, and mastery orientation (Smart, 2014). In this study, teachers' teaching behaviour will be examined as a mediator between teachers' transformational leadership practices and students' interest in science. Teachers' teaching behaviour is expected to mediate the relationship between teachers' transformational leadership practices and students' interest in science because it is the teacher's behaviour that directly affects students' learning outcomes (Rashid & Zaman, 2018).

METHODOLOGY

Research Design and Study Procedure

A non-experimental survey research approach is employed in this study. As described by Djamba (2002), survey research is a quantitative approach that involves posing a series of questions to a group of individuals (respondents) in order to gather information about their beliefs, views, characteristics, and past or present behaviours. The use of a questionnaire administered via the Google Form application further enhances the survey method chosen for this study.

The Google Form questionnaires link was shared with the students via their respective class teachers. Before distributing the questionnaires to the participating students, clear information about the research objectives and scope was provided to them. Students were also assured that all information and responses provided by them would be treated as confidential, and no students would be recognized. The researcher took necessary precautions to protect the privacy and personal data of all participants, ensuring that all collected data would be stored securely and used only for the intended research purpose. The students were informed about their voluntary participation in the study and were assured that their involvement was entirely optional. No form of coercion or pressure was exerted to encourage participation.

The data collected from the study undergoes comprehensive analysis, encompassing both descriptive and inferential techniques. Descriptive analysis is employed to gain insights into the demographic profile of the respondents, providing a thorough understanding of their background characteristics. Correlation analysis is used to assess the statistical significance of the relationships among the variables. The PROCESS Macro for SPSS is employed to investigate the potential influence of the mediating variables.

Population and Sampling

The population of interest consists of students enrolled in private schools located in Klang Valley, Malaysia. Sampling involves the process of selecting a subset of individuals from a larger population to participate in a study (Chua, 2012). For the present study, a sample of 250 students, spanning from Form 1 to Form 3 and aged 13 to 15 years old, was selected from private secondary schools using random sampling.

The demographic characteristics of the respondents, including gender, age, grade level, grade in the previous science exam, and attendance or participation in science competitions or workshops, were analysed and presented in Table 1 for easy reference.

Table 1
Percentage Analysis for the Demographic Information of the Respondents

	Demographic Profile	Frequency	Percentage (%)
Gender	Male	130	52%
	Female	120	48%
Age	13 years old	41	16.4
	14 years old	89	35.6
	15 years old	120	48.0
Grade Level	Form 1	41	16.4
	Form 2	89	35.6
	Form 3	120	48.0

Grade in the previous science exam	Grade A	76	30.4
	Grade B	54	21.6
	Grade C	50	20.0
	Grade D	46	18.4
	Grade E	12	4.8
	Grade F	12	4.8
Students' attendance or participation in any science competition or science workshop	Yes	87	34.8
	No	163	65.2

Private Schools

Focusing on private schools offers several justifications for this study. Private schools possess unique characteristics and educational contexts that may influence the relationship between teaching behaviour, transformational leadership practices, and students' interest in science differently than in public schools. Firstly, private schools typically have smaller class sizes and more resources compared to public schools (Yaacob et al., 2015). These favourable conditions may allow teachers in private schools to implement innovative teaching approaches, provide individualized attention, and create a supportive learning environment, potentially influencing students' interest in science (Wermuth, 2020). Investigating these factors within the private school setting can provide valuable insights into the impact of teaching behaviour and transformational leadership on students' interest in science, specifically in a context characterized by smaller class sizes and better resources. Furthermore, private schools often offer specialized curricula and programmes, which may incorporate unique approaches to science education. These curricular innovations may include hands-on laboratory experiences, interdisciplinary connections, and integration of technology, all of which have been found to positively influence students' interest in science (Banks & Barlex, 2020). Exploring the role of teaching behaviour and transformational leadership within this context can provide insights into how these factors interact with specialized curricula to enhance students' interest in science. For the purpose of this study, only private schools in the Klang Valley that adhere to the education syllabus of the Malaysian government (national curriculum) have been selected. Klang Valley was chosen due to its highest concentration of private schools in Malaysia compared to other states, as reported by the MOE (2022).

Research Instrument

The selection of instruments for this study was based on the research objectives and a review of relevant literature. The Transformational Teaching Questionnaire (TTQ) survey instrument, developed by Beauchamp et al. (2010), was utilized to assess teachers' transformational leadership practices. The Student Interests and Motivation in Science Questionnaire (SIMSQ), developed by Hassan (2008), was used to measure students' interest in science. In addition, the Teacher Behaviour Inventory (TBI), a validated 32-item tool developed by Hadie et al. (2019), was employed to evaluate teachers' teaching behaviour. Permission to use these instruments was obtained from the original developers via email.

The questionnaire was divided into four distinct parts, encompassing a total of 90 items for respondents to provide their answers. Part A of the questionnaire consisted of 5 questions that gathered demographic information from the respondents. Parts B to D required respondents to rate their level of agreement or disagreement with statements related to their science teachers' transformational leadership practices, teaching behaviour, and interest in science. A summary of the research instruments employed in this study can be found in Table 2.

Table 2:
Instruments used summary

Part	Instrument	Developer	Number of Items
A	Student Demographic Profile	Self	5
B	Transformational Teaching Questionnaire (TTQ)	Beauchamp et al., 2010	16
C	Teacher Behaviour Inventory (TBI)	Hadie et al., 2019	32
D	Student Interests and Motivation in Science Questionnaire (SIMSQ)	Hassan, 2008	37
		TOTAL	**90**

Table 3 provided below presents the dimensions of teacher's transformational leadership and the number of items associated with each dimension.

Table 3
Teacher's Transformational Leadership: Items Count and Their Respective Dimensions

No.	Dimensions	No of Items
1	Idealized Influence	4
2	Inspirational Motivation	4
3	Intellectual Stimulation	4
4	Individualized Consideration	4
	TOTAL	**16**

Table 4 presented details regarding the quantity of items and their respective dimensions that are associated with the teacher's teaching behaviour.

Table 4
Teacher's Teaching Behaviour: Items Count and Their Respective Dimensions

No.	Dimensions	No of Items
1	Clarity	6
2	Enthusiasm	4
3	Interaction	5
4	Organization	5
5	Disclosure	4
6	Speech and Pacing	4
7	Rapport	4
	TOTAL	**32**

Table 5 displayed below, presents details regarding the quantity of items and their respective dimensions that are associated with students' interest in science.

Table 5
Student's Interest in Science: Items Count and Their Respective Dimensions

No.	Dimensions	No of Items
1	Motivation for science	8
2	Enjoyment of science	6
3	Lack of anxiety	4
4	Usefulness of science	6
5	Self-concept of ability	3
6	Career interest	5
7	Ability to make choices	5
	TOTAL	**37**

The questionnaires underwent content validity, which involves obtaining input from a panel of experts to evaluate the clarity and comprehensibility of the questions (Creswell, 2014). For this particular research, the researcher sought feedback from two education experts who reviewed the pilot study questionnaire to assess the validity of the items included in the questionnaires. The questionnaire was subsequently revised based on the suggestions and recommendations provided by the panel of experts.

Data Analysis

For quantitative data, statistical software SPSS was employed, and inferential statistical techniques were employed to address the four research questions of this study. Data analysis involved Pearson correlation and PROCESS Macro for SPSS. Prior to conducting data analysis, the researcher conducted a test to assess the normal distribution of the data, ensuring the appropriateness of the analytical methods used. The normality of the data was examined using the Skewness and Kurtosis test, as recommended by George and Mallery (2016) and Pallant (2013). In addition, the normality of the data was also assessed using histograms and normal probability plots, all of which indicated that the data was normally distributed.

FINDINGS

Relationship between teachers' transformational leadership practices and students' interest in science

The study findings suggest a significant positive relationship between teachers' transformational leadership practices and students' interest in science, with a correlation coefficient of $r = .565$ ($p < .01$), as indicated in Table 6. The correlation value suggests a strong positive association between the two variables, indicating that as teachers' transformational leadership practices increase, students' interest in science also tends to increase.

Table 6
Pearson Correlation Matrix Between Teachers' Transformational Leadership Practices and Students' Interest in Science

Variables		**Students'** Interest in Science
Teachers' Transformational Leadership Practices	Pearson Correlation	.565**
	Sig. (2-tailed)	.000
	N	250

**Correlation is significant at the 0.01 level (2-tailed)

Upon conducting correlation analysis between each dimension of teachers' transformational leadership practices and students' interest in science, as perceived by students, the findings suggest a range of correlation strengths from strong to moderate, as depicted in Table 7. The results also indicate that all dimensions of teachers' transformational leadership practices have a significant relationship with students' interest in science. The dimension of intellectual stimulation shows the strongest correlation with students' interest in science ($r = .584$, $p < .01$), followed by inspirational motivation ($r = .535$, $p < .01$), idealized influence ($r = .525$, $p < .01$), and individualized consideration ($r = .465$, $p < .01$), which reveals a significant and moderate strength of correlation.

Table 7
Correlation Analysis Between Dimension of Teachers' Transformational Leadership Practices and Students' Interest in Science

Dimensions	**Students'** Interest in Science	Correlation Strength
Intellectual Stimulation	.584**	Strong
Inspirational Motivation	.535**	Strong
Idealized Influence	.525**	Strong

Individualized Consideration	.465**	Moderate

**Correlation is significant at the 0.01 level (2-tailed)

Relationship between teachers' transformational leadership practices and teachers' teaching behaviour

As per Table 8, the findings reveal a significant and strong positive correlation (r = .797, p < .01) between the level of teachers' transformational leadership practices and their teaching behaviour. This implies that when science teachers demonstrate transformational leadership practices, their teaching behaviour tends to increase positively.

Table 8

Pearson Correlation Matrix Between Teachers' Transformational Leadership Practices and Teachers' Teaching Behaviour

Variables		**Teachers'** Teaching Behaviour
Teachers' Transformational Leadership Practices	Pearson Correlation	.797**
	Sig. (2-tailed)	.000
	N	250

**Correlation is significant at the 0.01 level (2-tailed)

The Pearson product-moment coefficient analysis was utilized to determine the strength of the relationship between the dimensions of teachers' transformational leadership practices and teachers' teaching behaviour, as shown in Table 9. The findings reveal strong and positive relationships among these dimensions. The correlation coefficients (r) are in ascending order from intellectual stimulation (r = .712, p < .01) to individualized consideration (r = .779, p < .01). Similarly, idealized influence (r = .725, p < .01) and inspirational motivation (r = .760, p < .01) also exhibit significant and strong relationships with teachers' teaching behaviour.

Table 9

Correlation Analysis Between Dimension of Teachers' Transformational Leadership Practices and Teachers' Teaching Behaviour

Dimensions	**Teachers'** Teaching Behaviour	Correlation Strength
Individualized Consideration	.779**	Very strong
Inspirational Motivation	.760**	Very strong
Idealized Influence	.725**	Very strong
Intellectual Stimulation	.712**	Very strong

**Correlation is significant at the 0.01 level (2-tailed)

Relationship ***Between Teachers' Teaching Behaviour And Students' Interest In Science***

Table 10 presents evidence of a statistically significant association between the level of teachers' teaching behaviour and students' interest in science, with a correlation coefficient of .568 (p < .01). The positive and strong correlation coefficient suggests that a favourable teaching behaviour exhibited by science teachers is associated with an increase in students' interest in science.

Table 10

Pearson Correlation Matrix Between Teachers' Teaching Behaviour and Students' Interest in Science

Variables		**Students'** Interest in Science
Teachers' Teaching Behaviour	Pearson Correlation	.568**
	Sig. (2-tailed)	.000
	N	250

**Correlation is significant at the 0.01 level (2-tailed)

Furthermore, Table 11 provides an overview of the correlations between all seven dimensions of teachers' teaching behaviour and students' interest in science. These correlations were found to be statistically significant, ranging from weak to strong in strength. The results highlight that among the seven dimensions, the rapport dimension ($r = .605$, $p < .01$) exhibited the strongest association with students' interest in science, followed by the organization dimension ($r = .548$, $p < .01$), clarity dimension ($r = .545$, $p < .01$), interaction dimension ($r = .522$, $p < .01$), and disclosure dimension ($r = .500$, $p < .01$). The enthusiasm dimension ($r = .353$, $p < .01$) and "speech & pacing" dimension ($r = .111$, $p < .01$), on the other hand, revealed significantly positive correlations at a moderate and weak strength, respectively.

Table 11
Correlation Analysis Between Dimension of Teachers' Teaching Behaviour and Students' Interest in Science

Dimensions	**Students'** Interest in Science	Correlation Strength
Rapport	.605**	Strong
Organization	.548**	Strong
Clarity	.545**	Strong
Interaction	.522**	Strong
Disclosure	.500**	Strong
Enthusiasm	.353**	Moderate
Speech & Pacing	.111**	Weak

**Correlation is significant at the 0.01 level (2-tailed)

Teachers'* Teaching Behaviour Mediate the Relationship Between *Teachers' Transformational Leadership Practices And Students' Interest In Science

The results revealed that students' interest in science was regressed with teachers' transformational leadership practices, yielding a coefficient corresponding to path c as depicted in Figure 2. The unstandardized regression coefficient for this total effect was: $c = .3374$, $SE = .0313$, $p < .05$. The analysis revealed that teachers' transformational leadership practices significantly predicted teachers' teaching behaviour (path a), with the unstandardized regression coefficient $a = .5859$, $SE = .0282$, $p < .05$. Additionally, teachers' teaching behaviour significantly predicted students' interest in science (path b), with $b = .2627$, $SE = .0686$, $p < .05$. The direct effects of teachers' transformational leadership practices on students' interest in science through teachers' teaching behaviour (path c') are presented in the mediation model as depicted in Figure 2.

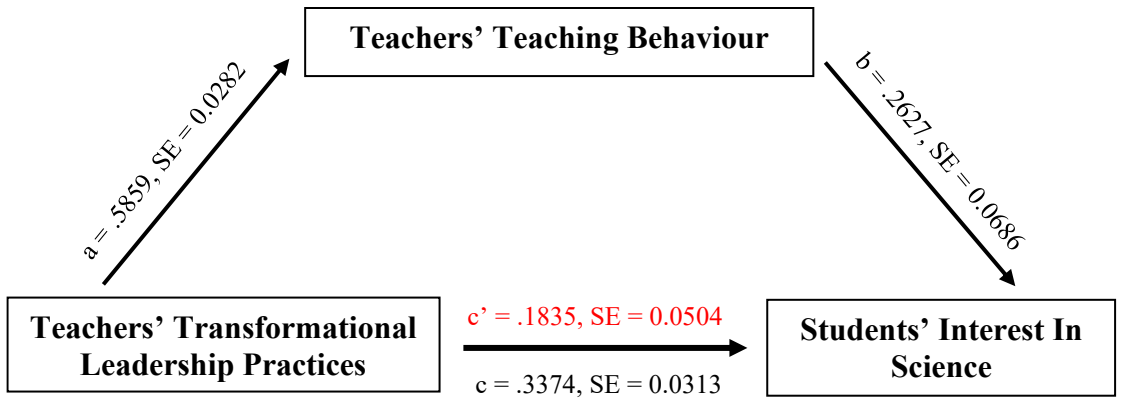

Figure 2. *Direct effects of Teachers' Transformational Leadership Practices on Students' Interest in Science via Teachers' Teaching Behaviour (path c')*

In the current study, mediation analyses were conducted using 5000 bootstrapped samples with bias-corrected and accelerated 95% confidence intervals. The results revealed that the indirect coefficient was significant, with (a.b) = .1539, SE = .0405, $p < .05$, and a 95% confidence interval of .0717 - .2371, as presented in Table 12. According to the criteria set by Hayes and Preacher (2010), a mediation is considered significant if zero does not fall within the confidence interval. Thus, in this study, the indirect effect was found to be statistically significant.

The mediating effect can be calculated as the difference between the total effect and the direct effect, denoted as c - c' = .3374 - .1835 = .1539. As stated by Ferguson (2009), effect size reflects the strength of the relationship between variables. In this investigation, the effect size is determined to be moderate, with a value of .1539 (Ferguson, 2009).

In the final step, the strength of the mediation is assessed using the Variable Accounted For (VAF) index, as explained by Hair et al. (2013). The VAF is calculated as VAF = ab/(c'+ab). In this study, the VAF for the indirect effect is determined to be 45.6%, indicating that teachers' teaching behaviour partially mediates the relationship between teachers' transformational leadership practices and students' interest in science. The results suggest that transformational leadership practices of teachers can positively impact students' interest in science through their teaching behaviour. Specifically, when science teachers exhibit high levels of transformational leadership practices, it can be predicted that students' interest in science will also be high, facilitated by the teachers' effective teaching behaviour.

Table 12
Bootstrap Results of the Total, Direct, and Indirect Effects of the Mediation Analysis (N = 250; 5000 bootstrap samples)

Pathways	Unstandardized coefficient	SE	P (two-tailed)	95% Confidence Interval	
				CI Lower Level	CI Upper Level
Total effect (unmediated, path c) TTLP → SIC	.3374	.0313	0.000	.2758	.3990
Direct effect **(mediated, path c')** TTLP → SIC	.1835	.0504	0.003	.0842	.2828
Indirect effects					
TTLP → TTB (path a)	.5859	.0282	0.000	.5303	.6414
TTB → SIC (path b)	.2627	.0686	0.002	.1276	.3978
TTLP-TTB-SIC (a*b)	. 1539	.0405	0.000	.0717	.2371

Note: TTLP: Teachers' Transformational Leadership Practices; SIC: Students' Interest in Science; TTB: Teachers' Teaching Behaviour

DISCUSSION

The study's results revealed a strong positive correlation between teachers' employment of transformational leadership practices and students' level of interest in science. The significance of this correlation implies that as teachers' utilization of transformational leadership practices increases, so does students' interest in science. This may be motivated by the desire to ensure high academic achievement, student retention, and attract more parents to enrol their children in fee-paying private schools. Teachers' utilization of transformational leadership practices can effectively motivate students to actively participate in scientific inquiry, develop a genuine curiosity for science, and recognize the relevance of science in their daily lives (Elliott & Asghar, 2014). It is noteworthy to mention that although there is a strong overall relationship between teachers' transformational leadership practices and

students' interest in science, the dimension of individualized consideration within transformational leadership exhibited the least correlation (r = .465) with students' interest in science. This implies that while individualized consideration may have significance in transformational leadership, it may not be as pivotal in fostering students' interest in science compared to other dimensions such as intellectual stimulation, inspirational motivation, or idealized influence.

As perceived by students in private schools, the results revealed a positive and statistically significant association between teachers' utilization of transformational leadership practices and their teaching behaviour. These findings align with previous research that has demonstrated a strong connection between teachers' transformational leadership practices and teaching outcomes (Noland, 2005; Zhao et al., 2021). The study underscores the importance of dimensions such as individualized consideration, inspirational motivation, idealized influence, and intellectual stimulation in shaping teachers' teaching practices and improving their instructional approaches. Moreover, the most significant correlation was observed in the individualized consideration dimension of transformational leadership practices and teachers' teaching behaviour (r = .779), suggesting that teachers who exhibit a high level of individualized consideration are more inclined to tailor their teaching to the unique needs and learning styles of their students. This finding underscores the significance of personalized learning and underscores the importance for teachers to cultivate a supportive learning environment that addresses the diverse needs of their students. This aligns with the results of a study by Lee et al. (2021), which proposed that teachers' consideration of task goals and students' characteristics may impact their intention to implement learner-centered pedagogy, ultimately influencing students' outcomes. Thus, the findings indirectly suggest that individualized consideration plays an important and positive role in students' outcomes, leading to improved teaching behaviour.

Besides, the findings of this study indicate a significant and positive association between teachers' teaching behaviour and students' interest in science, with a strong correlation coefficient. These findings align with previous research conducted in other countries such as Australia and Estonia, which also reported a positive relationship between teachers' teaching behaviour and students' interest in science, as evidenced by studies conducted by Logan and Skamp (2013) and Teppo et al. (2021). This study provides compelling evidence that teachers' teaching behaviour, specifically in terms of rapport, organization, clarity, interaction, and disclosure, significantly influences students' interest in science.

The mediation analysis demonstrated that teachers' teaching behaviour partially mediated the relationship between their transformational leadership practices and students' interest in science, with a moderate effect size of .1539. This suggests that teachers' transformational leadership practices enhance students' interest in science through the mediating role of teachers' teaching behaviour. Nurturing transformational leadership practices among teachers and promoting effective teaching behaviours are important in boosting students' motivation and engagement in science. Private schools need to prioritize the development and support of teachers' transformational leadership practices and effective teaching behaviours to enhance students' interest in science and overall DLP success.

CONCLUSION

In conclusion, the findings underscore the important role of transformational leadership and effective teaching behaviour exhibited by qualified and competent science teachers in enhancing students' interest in science and ensuring the sustainability of DLP in private schools, particularly in the urban Klang Valley area of Malaysia. It is imperative for private schools to prioritize the recruitment, professional development, and support of qualified science teachers who are capable of delivering lessons in English, fostering transformational leadership practices, and promoting effective teaching behaviour to establish a conducive learning environment. By taking these steps, private schools can attract more parents to enrol their children and establish themselves as institutions that provide high-quality science education with a strong emphasis on student interest, engagement, and academic success. The practical suggestions provided by this study can also serve as a valuable resource for teachers and educators to enhance students' interest in science education and improve their overall academic performance.

Furthermore, this study also addresses a significant research gap in the literature. Prior studies have examined the individual effects of teachers' transformational leadership practices and teaching behaviour on students' interest in science. However, this study uniquely explores the mediating role of teachers' teaching behaviour in the relationship between their transformational leadership practices and students' interest in science.

School administrators can play a role by providing professional development opportunities for teachers to improve their leadership and teaching skills. Policymakers can also consider incorporating training on transformational leadership practices and effective teaching behaviour in teacher preparation programmes and professional development initiatives. Additionally, further research can explore other potential mediators and moderators in the relationship between teachers' leadership practices, teaching behaviour, and students' interest in science, to gain a more comprehensive understanding of this complex relationship.

REFERENCES

Banks, F., & Barlex, D. (2020). *Teaching STEM in the secondary school: Helping teachers meet the challenge*. Routledge.

Bass, B. M., & Riggio, R. E. (2006). *Transformational leadership*, 2nd edn. Mahwah, NJ: Erlbaum.

Beauchamp, M. R., Barling, J., Li, Z., Morton, K. L., Keith, S. E., & Zumbo, B. D. (2010). Development and psychometric properties of the transformational teaching questionnaire. *Journal of Health Psychology*, *15*(8), 1123-1134.

Betsy, L.L.N., Liu, W.C, & John, C.K.W. (2016). Student motivation and learning in mathematics and Science: A cluster analysis. *International Journal of Science and Mathematics Education, 14*(7), 1359-1376.

Bhandari, P. (2022, December 05). Correlation Coefficient | Types, Formulas & Examples. Scribbr. Retrieved April 16, 2023, from https://www.scribbr.com/statistics/correlation-coefficient/

Bogler, R., Caspi, A., & Roccas, S. (2013). Transformational and passive leadership: An initial investigation of university instructors as leaders in a virtual learning environment. *Educational Management Administration & Leadership, 41*(3), 372-392.

Bolkan, S., & Goodboy, A.K. (2009). Transformational Leadership in the Classroom: Fostering Student Learning, Student Participation, and Teacher Credibility. *Journal of Instructional Psychology, 36*, 296-307.

Bolkan, S., Goodboy, A.K., & Griffin, D.J. (2011). Teacher Leadership and Intellectual Stimulation: Improving Students' Approaches to Studying through Intrinsic Motivation. *Communication Research Reports, 28*, 337 - 346.

Bostock, J. (2018). Transformational Leadership: encouraging and supporting creativity, collaboration and the pursuit of teaching excellence.

Brophy, J. (2008). Developing students' appreciation for what is taught in school. *Educational psychologist, 43*(3), 132-141.

Carroll, A., Houghton, S., Wood, R., Unsworth, K., Hattie, J., Gordon, L., & Bower, J. (2009). Self-efficacy and academic achievement in Australian high school students: The mediating effects of academic aspirations and delinquency. *Journal of adolescence, 32*(4), 797-817.

Chua, Y. P. (2012). *Mastering research methods*. Shah Alam: Mcgraw-Hill Education.

Creswell, J. W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches. Thousand Oaks: Sage publications.

Djamba, Y. K. (2002). Social research methods: Qualitative and quantitative approaches. *Teaching Sociology, 30*(3), 380-381.

Elliott, K., & Asghar, A. (2014). Transformational Leadership in Science Education: A Quebec Perspective. In *Reframing Transformational Leadership* (pp. 99-115). Brill.

Ferguson, C. J. (2009). An effect size primer: A guide for clinicians and researchers. *Professional Psychology: Research and Practice, 40*(5), 532–538.

Fernando, S. Y., & Marikar, F. M. (2017). Constructivist Teaching/Learning Theory and Participatory Teaching Methods. *Journal of Curriculum and Teaching, 6*(1), 110-122.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of educational research, 74*(1), 59-109.

Fricke, K., van Ackeren, I., Kauertz, A., & Fischer, H. E. (2012). Students' perceptions of their teachers' classroom management in elementary and secondary science lessons and the impact on student achievement. In *Interpersonal relationships in education* (pp. 167-185). Brill.

George, D., & Mallery, P. (2016). The one-way ANOVA procedure. In *IBM SPSS Statistics 23 Step by Step* (pp. 173-182). Routledge.

Granger, E.M., Bevis, T.H., Saka, Y., Southerland, S.A., Sampson, V.D., & Tate, R. (2012). The Efficacy of Student-Centered Instruction in Supporting Science Learning. *Science, 338*, 105 - 108.

Hadie, S. N. H., Hassan, A., Talip, S. B., & Yusoff, M. S. B. (2019). The teacher behaviour inventory: validation of teacher behaviour in an interactive lecture environment. *Teacher Development*, *23*(1), 36-49.

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2013). Partial least squares structural equation modeling: Rigorous applications, better results and higher acceptance. *Long range planning, 46*(1-2), 1-12.

Harackiewicz, J. M., Smith, J. L., & Priniski, S. J. (2016). Interest matters: The importance of promoting interest in education. *Policy insights from the behavioral and brain sciences, 3*(2), 220-227.

Hassan, G. (2008). Attitudes toward science among Australian tertiary and secondary school students. *Research in Science & Technological Education, 26*(2), 129-147.

Hattie, J. (2012). *Visible learning for teachers: Maximizing impact on learning*. Routledge.

Hayes, A. F., & Preacher, K. J. (2010). Quantifying and testing indirect effects in simple mediation models when the constituent paths are nonlinear. *Multivariate behavioral research, 45*(4), 627-660.

Helm, J. H., & Katz, L. G. (2016). *Young investigators: The project approach in the early years*. Teachers College Press.

Hidi, S., & Harackiewicz, J. M. (2000). Motivating the academically unmotivated: A critical issue for the 21st century. *Review of educational research, 70*(2), 151-179.

Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. *Educational psychologist, 41*(2), 111-127.

Kamran, F., Afzal, A., & Rafiq, S. (2022). TEACHERS' BEHAVIOR INFLUENCING THE CLASSROOM PARTICIPATION OF UNIVERSITY STUDENTS. *Journal of Social Research Development, 3*(2), 173-192.

Kiemer, K., Gröschner, A., Pehmer, A-K., & Seidel, T. (2015). Effects of a classroom discourse intervention on teachers' practice and students' motivation to learn mathematics and Science. *Learning and Instruction, 35*: 94-103.

Ko, H., Park, H., & Kwon, D. (2022). A Study on the Influence of Teacher's Transformational Leadership and Students' Followership toward Student Engagement Perceived by Elementary School Students. *Korean Association For Learner-Centered Curriculum And Instruction*.

Lai, E., & Cheung, D. (2015). Enacting teacher leadership: The role of teachers in bringing about change. *Educational Management Administration & Leadership, 43*(5), 673–692.

Lee, W.C., Der-Thanq Chen, V., & Wang, L. (2021). Science teachers' consideration: a phenomenographic study of learner-centred teaching analysis. *Teacher Development, 25*, 296 - 316.

Logan, M., & Skamp, K. (2013). The Impact of Teachers and Their Science Teaching on Students' 'Science Interest': A four-year study. *International Journal of Science Education, 35*, 2879 - 2904.

MOE. (2022). Portal Rasmi Kementerian Pendidikan Malaysia. Retrieved from https://smips.moe.gov.my/utama.cfm?cari

Morton, K. L., Keith, S. E., & Beauchamp, M. R. (2010). Transformational teaching and physical activity: A new paradigm for adolescent health promotion?. *Journal of Health Psychology, 15*(2), 248-257.

Noland, A. K. (2005). *The relationship between teacher transformational leadership and student outcomes* (Doctoral dissertation, Miami University).

Ormrod, J. E. (2011). *Educational psychology: developing learners*. 7th ed. Boston, Pearson/Allyn & Bacon.

Ovando, M.N. (2020). Effects of Teachers' Leadership on Their Teaching Practices.

Pallant, J. (2010). SPSS Survival Manual, 4th edn, Maidenhead.

Plenty, S., & Heubeck, B. G. (2013). A multidimensional analysis of changes in mathematics motivation and engagement during high school. *Educational Psychology, 33*(1), 14-30.

Potvin, P., & Hasni, A. (2014). Interest, motivation and attitude towards Science and technology at K-12 levels: a systematic review of 12 years of educational research. *Studies in Science education, 50*(1), 85-129.

Priya, K. (2018). Key Factors Influencing Parental Choice of School for their Children in Namakkal District. *HuSS: International Journal of Research in Humanities and Social Sciences, 5*(2), 85-91.

Rashid, M. A. U. H., & Zaman, S. (2018, February). Effects of teacher's behavior on academic performance of students. In *3rd International Conference on Research and Practices in Education* (Vol. 1, p. 15).

Resnick, L. B. (2017). Toward a cognitive theory of instruction. In *Learning and motivation in the classroom* (pp. 5-38). Routledge.

SchoolAdvisor.my. (2021, February 23). Dual Language Programme in National and Private Schools and the Second Language Integration in International Schools. Retrieved July 22, 2023, from https://schooladvisor.my/articles/dual-language-programme-in-national-and-private-schools-and-the-second-language-integration-in-international-schools

Slavich, G.M., & Zimbardo, P.G. (2012). Transformational Teaching: Theoretical Underpinnings, Basic Principles, and Core Methods. *Educational Psychology Review, 24*, 569-608.

Smart, J.B. (2014). A Mixed Methods Study of the Relationship between Student Perceptions of Teacher-Student Interactions and Motivation in Middle Level Science. *RMLE Online, 38*, 1 - 19.

Teppo, M., Soobard, R., & Rannikmäe, M. (2021). GRADE 6 & 9 STUDENT AND TEACHER PERCEPTIONS OF TEACHING AND LEARNING APPROACHES IN RELATION TO STUDENT PERCEIVED INTEREST/ENJOYMENT TOWARDS SCIENCE LEARNING. *Journal of Baltic Science Education, 20*, 119-133.

Tsai, K. C. (2015). A preliminary meta-analysis of teacher leadership. *Journal of Education and Literature*, *3*(3), 131-137.

Vedder-Weiss, D., & Fortus, D. (2012). Adolescents' declining motivation to learn Science: A follow-up study. *Journal of Research in Science Teaching, 49*(9), 1057-1095.

Wermuth, S. (2020). Innovative and Engaging Approaches in a Middle School Science Classroom: Ideas to Capitalize on Student Interest. *International Journal of the Whole Child, 5*(2), 41-49.

Wespieser, K. (2015). How do parents choose a school?. *Seced, 2015*(16), 13-13.

Woods-McConney, A., Oliver, M. C., McConney, A., Maor, D., & Schibeci, R. (2013). Science engagement and literacy: A retrospective analysis for Indigenous and non-Indigenous students in Aotearoa New Zealand and Australia. *Research in Science Education, 43*(1), 233-252.

Yaacob, N.A., Osman, M.M., & Bachok, S. (2015). An Assessment of Factors Influencing Parents' Decision Making When Choosing a Private School for their Children: A Case Study of Selangor, Malaysia: for Sustainable Human Capital. *Procedia environmental sciences, 28*, 406-417.

Zhao, J., Hou, H.Y., & Yin, J. (2021). The Relationship Between Teacher Transformational Leadership and Students' Motivation to Learn in Higher Education. *Higher Education of Social Science, 20*, 39-51.