

Investigating Students' Perception and Interest in Physics Education at the Secondary School Level in Selangor

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Abstract

Physics is one of the most fundamental branches of the physical sciences, yet its perceived difficulty has contributed to declining interest among secondary school students, raising concern within Malaysian science education. This study examined secondary school students' perception of, and interest in, learning Physics in Selangor, with three objectives: (1) to identify students' interest in learning Physics, (2) to examine the challenges students face in learning Physics, and (3) to determine the strategies Physics teachers use to boost students' interest. A mixed-methods design was employed, combining two quantitative surveys and one qualitative interview. Data for the first two objectives were gathered through Likert-scale questionnaires completed by 143 and 100 Form 4 science-stream students respectively, and analysed descriptively using SPSS. Data for the third objective were obtained from semi-structured interviews with three Physics teachers, analysed thematically. Findings show that students' interest is closely tied to Physics' relevance to real-world phenomena but is undermined by weak mathematical foundations and a persistent perception of Physics as a difficult subject. Teachers reported that a shortage of laboratory apparatus constrained their ability to sustain active, student-centred strategies for building interest.

Keywords: Physics Education, Students' Interest, Students' Perception, Learning Challenges, Teaching Strategies

Introduction

Physics is widely regarded as one of the most fundamental and exact branches of the physical sciences, underpinning fields as diverse as engineering, medicine, and environmental science (Brown & Weidner, 2021). Despite its centrality to technological and scientific literacy, Physics is consistently perceived by students as one of the least attractive science subjects, trailing behind Chemistry and Biology in popularity (Oon & Subramaniam, 2010). In Malaysia, this concern is reflected in the continuing challenge of encouraging students to participate in science and STEM-related pathways. Although the Ministry of Education has targeted a 60:40

ratio of science-to-arts stream students in upper secondary school, only 47.18% of upper secondary students participated in STEM-related streams as of the Ministry's 2020 Annual Report (Farook, 2021). Physics is introduced as an elective subject in the science stream from Form 4 onwards under the Secondary School Curriculum Standards (KSSM), which replaced the earlier Integrated Curriculum in line with the Malaysia Education Blueprint 2013–2025 (Farihah et al., 2019). Yet, Physics continues to be perceived as a demanding subject requiring students to simultaneously master mathematical formulae, graphs, diagrams, and experimental procedures (Djudin, 2018). Where students lack confidence in these areas, disengagement and declining interest may follow (Lee & Sulaiman, 2018).

Previous Malaysian studies have provided useful evidence regarding students' attitudes, perceptions, and difficulties in learning Physics. For example, Ibrahim et al. (2019) investigated Form 4 students in Klang, Selangor, and found that although the majority of students demonstrated favourable attitudes towards Physics, the nature of the topic was identified as a major challenge in learning force and motion. The authors further suggested the need for more in-depth research involving a larger number of participants and Physics teachers. Other Malaysian research has similarly examined students' perceptions of Physics, including the perceived difficulty of Physics topics, pedagogical approaches, and factors influencing students' interest (Ziad et al., 2021). More recent studies have also examined specific instructional approaches for addressing students' difficulties in particular Physics topics (e.g., free-fall motion), rather than examining students' perceptions and learning challenges together with teachers' strategies for sustaining interest (Author, Year).

Despite these contributions, an important gap remains in the Malaysian and, particularly, Selangor context. Existing studies have generally examined students' attitudes, perceptions, learning difficulties, or particular teaching approaches as relatively separate areas of investigation. Less attention has been given to how students' perceptions and challenges can be examined alongside the strategies that Physics teachers actually use to address declining or limited student interest within the same study. This is important because students' disengagement cannot be fully understood from the student perspective alone; the instructional strategies available to teachers, as well as contextual constraints such as access to laboratory resources, may influence how students experience and respond to Physics learning. Thus, examining both sides of the teaching and learning process can provide a more comprehensive understanding of the factors shaping students' interest in Physics.

The distinctive contribution of the present study therefore lies in bringing together three complementary dimensions within a single investigation: students' interest and perceptions of Physics, the challenges they experience when learning the subject, and the strategies employed by Physics teachers to enhance student interest. Rather than examining these dimensions independently, the study uses quantitative evidence from students and qualitative accounts from teachers to provide a more integrated picture of Physics learning in public secondary schools in Selangor. The mixed-methods design also allows students' reported experiences to be considered alongside teachers' perspectives and classroom practices, thereby providing a form of triangulation between learners' experiences and teachers' instructional responses. This approach responds to the need for more contextualised evidence on how students' difficulties and perceptions may be connected to practical teaching strategies in Malaysian secondary school Physics education.

Accordingly, the present study examined secondary school students' perception of, and interest in, learning Physics in Selangor, while also identifying the strategies Physics teachers use to sustain and enhance that interest. Specifically, the study addressed three objectives: (1) to identify secondary school students' interest in learning Physics; (2) to examine the challenges faced by secondary school students in learning Physics; and (3) to determine Physics teachers' strategies for boosting students' interest in learning Physics. Correspondingly, three research questions guided the study: (i) What are secondary school students' interests in learning Physics? (ii) What challenges do secondary school students face in learning Physics? and (iii) What strategies do Physics teachers use to boost students' interest in learning Physics?

The findings are intended to benefit three groups of stakeholders. For teachers, the results offer insight into how instructional approaches might be better aligned with students' interests and learning difficulties, enabling early identification of disengaged students and more targeted intervention. For the Ministry of Education, the findings can inform curriculum development, teacher professional development, and resource allocation, particularly concerning laboratory apparatus and facilities. For students, a clearer understanding of their perceptions and learning challenges may support greater awareness of the factors influencing their engagement and provide a basis for improving their learning of Physics. The study was conducted among Form 4 science-stream students and Physics teachers in public secondary schools in Selangor. As Form 4 marks students' first formal exposure to Physics as a discrete subject, this population offers a useful vantage point for examining early perceptions, learning challenges, and interest formation in Physics.

Literature Review

Theoretical Framework

This study is guided by two complementary theoretical perspectives: John Dewey's theory of experiential, progressive education, and Piaget's Cognitive Learning Theory. Dewey's pragmatist philosophy of education holds that learning is fundamentally a social process, best achieved through hands-on, experiential engagement rather than passive transmission of content (Howley-Rouse, 2021; Mike, 2020). Dewey argued that teachers should act as facilitators who anchor abstract subject matter in real-world application, thereby cultivating students' intrinsic interest and autonomy (Opinaldo, 2022). Within Physics education, this suggests that student interest can be strengthened when teachers connect formulae and principles to everyday phenomena rather than presenting them in isolation.

Piaget's Cognitive Learning Theory complements this perspective by emphasising the internal, constructive processes through which learners build new understanding on existing knowledge (McLeod, 2020). Cognitive learning, in this view, favours comprehension and application over rote memorisation (Jarre, 2020) — a distinction directly relevant to Physics, where students are frequently observed to rely on memorised formulae rather than conceptual understanding (Kedir & Wami, 2020). Together, these theories frame the conceptual model of this study: students' interest, the challenges they encounter, and the strategies teachers employ are treated as interconnected constructs, moderated by intervening factors such as school environment, family influence, career aspiration, and peer influence.

Students' Interest in Learning Physics

Interest is described as a lasting motivational orientation toward a topic, shaped by both personal disposition and situational context (Kurt, 2021). Evidence suggests that negative attitudes toward science in general tend to extend to Physics specifically (Noufal et al., 2020), and that engagement is often gendered, with some studies reporting higher interest among male students, attributable in part to curriculum content (Noufal et al., 2020). Reported drivers of disinterest include unfamiliarity with the subject matter, its reputation as the most difficult of the sciences, heavy reliance on rote learning in typical instruction, and anxiety about examination failure (Djudin, 2018).

Challenges Faced by Students in Learning Physics

Physics is widely reported to be cognitively demanding, requiring students to move fluidly between multiple representational forms — formulae, graphs, diagrams, and verbal explanations — while also possessing a solid grounding in mathematics (Bhaskara Reddy et al., 2017). Commonly identified challenges include insufficient prior mathematical knowledge, limited exposure to the practical application of concepts, and instruction perceived by students as unprepared or uninspiring (Bhaskara Reddy et al., 2017; Ince, 2018).

Teachers' Strategies to Boost Students' Interest

Teacher strategy is closely tied to Dewey's model of experiential learning: cultivating students' situational interest into sustained personal interest by revitalising course content, context, and learning activities (Djudin, 2018). Strategies documented in the literature include contextualising lessons with everyday examples, sequencing instruction from simple to complex, and using active questioning to sustain engagement (Karamustafaoglu, 2009). Broader reviews of active learning in STEM similarly link student-centred, participatory pedagogy to improved engagement and retention (Tomkin et al., 2019).

Conceptual Framework

Building on the reviewed literature, this study conceptualises students' interest, students' challenges, and teachers' strategies as three interrelated independent constructs feeding into the dependent outcome of students' overall engagement with Physics as a subject in secondary school. This relationship is moderated by intervening variables including school environment, family influence, career aspiration, and peer influence.

Methodology

Research Design

This study adopted a mixed-methods design, combining two quantitative survey instruments and one qualitative interview protocol. The first two research objectives — students' interest in Physics and the challenges they face — were addressed through online Likert-scale surveys administered via Google Forms and analysed descriptively using SPSS. The third objective — teachers' strategies — was addressed through semi-structured online interviews analysed using thematic analysis. This design combined the generalisability of quantitative survey data with the contextual depth of qualitative interview data, allowing the quantitative findings on students' interest and challenges to be triangulated against teachers' own accounts of their instructional practice.

Population and Sampling

The population comprised Form 4 science-stream students and Physics teachers in public secondary schools in Selangor. For the quantitative strand, a two-stage random (probability) sampling method was used: schools and classes were selected, followed by random selection of individual respondents within each class. A total of 143 students completed the first survey (interest and perception), and 100 students completed the second survey (challenges). For the qualitative strand, three Physics teachers were selected through purposive (non-probability) sampling.

Instrumentation and Reliability

Two instruments were used. The first was a structured questionnaire measuring students' interest in and perception of Physics, adapted from Akhter et al. (2019) and Dopatka et al. (2020), using a four-point Likert scale ranging from Strongly Disagree to Strongly Agree. The second questionnaire, addressing students' challenges, was adapted from Akhter et al. (2019). The interview protocol addressing teachers' strategies was adapted from Karamustafaoglu (2009) and comprised six open-ended questions covering teaching challenges, curriculum approaches, student-centred learning, active learning, and teachers' self-assessed effectiveness.

A pilot test was conducted to establish the internal consistency of the Likert-scale instruments using Cronbach's alpha. As shown in Table 1, all three subscales achieved coefficients within the "good" range, indicating acceptable reliability for the study's purposes.

Table 1

Reliability Statistics of the Survey Instruments

Construct	Cronbach's Alpha	No. of Items
Interest	.825	6
Perception	.830	7
Challenges	.853	14

Research Ethics

Ethical clearance was obtained through UiTM's Research Ethics Committee (REC) prior to data collection. Permission letters were subsequently secured from the Faculty of Education, UiTM Puncak Alam, and from the principals of participating schools. Informed consent was obtained from all student and teacher respondents, and the confidentiality of personal data was maintained throughout the study.

Data Analysis

Quantitative data were analysed descriptively in SPSS, generating frequency, mean, and standard deviation statistics for each survey item. Qualitative interview data were transcribed and analysed thematically, following a process of familiarisation, coding, and theme development, resulting in six overarching themes.

Findings

Demographic Profile

Table 2 summarises respondent demographics across both quantitative surveys.

Table 2

Demographic Profile of Student Respondents

Characteristic	Survey 1 (n = 143)	Survey 2 (n = 100)
Male	70 (49.0%)	54 (54.0%)
Female	73 (51.0%)	46 (46.0%)
Malay	49 (34.3%)	31 (31.0%)
Chinese	42 (29.4%)	37 (37.0%)
Indian	37 (25.9%)	25 (25.0%)
Other (Sabah/Sarawak Bumiputera)	15 (10.5%)	7 (7.0%)
Physics grade A	50 (35.0%)	37 (37.0%)
Physics grade B	30 (21.0%)	20 (20.0%)
Physics grade C	19 (13.3%)	15 (15.0%)
Physics grade D	18 (12.6%)	10 (10.0%)
Physics grade E	26 (18.2%)	18 (18.0%)

Three teachers also participated in the interview: one male teacher with 17 years of teaching experience, and two female teachers with two and one years of experience respectively.

RQ1: Students' Interest in Learning Physics

Table 3 presents mean scores for items measuring students' interest in Physics (N = 143). Students most strongly agreed that content learned in Physics lessons is applied in practice (M = 3.46, SD = .67) and that Physics explains many natural processes (M = 3.34, SD = .58). By contrast, the lowest-rated items were "I like Physics" and "I like to attend physics lessons" (both M = 3.13), suggesting comparatively limited enthusiasm despite students recognising the subject's real-world relevance.

Table 3

Students' Interest Towards Physics (N = 143)

Item	Mean	SD
Physics can explain many processes in nature.	3.46	.669
In physics lessons we learn how the content is applied in practice.	3.34	.583
I like to acquire new knowledge in physics.	3.29	.667
I find Physics useful in my daily life.	3.18	.708
I like Physics.	3.13	.740
I like to attend physics lessons.	3.13	.734

A complementary set of items examining students' broader perception of Physics as a subject (Table 4) found that the highest-rated item was agreement that Physics is the most difficult subject (M = 3.43, SD = .74), while the lowest-rated item — "I find Physics a boring subject" (M = 2.92, SD = .91) — suggests that most students do not, in fact, consider Physics boring.

Table 4

Students' Perception of Physics as a Subject (N = 143)

Item	Mean	SD
I think Physics is the most difficult subject.	3.43	.736
Understanding Physics is very important to me.	3.24	.864
Knowing Physics will help me in my career.	3.17	.628
I want to learn Physics because I enjoy it.	3.16	.811
I feel Physics easy to remember.	3.16	.947
Physics allows me to generate new concepts and ideas.	3.12	.783
I find Physics a boring subject.	2.92	.912

RQ2: Challenges Faced by Students in Learning Physics

Table 5 presents mean scores for the 14-item challenges scale (N = 100). The highest-rated challenge was difficulty in fully grasping Physics lessons (M = 2.91, SD = .99), followed by difficulty comprehending classroom procedures (M = 2.75, SD = 1.17). The lowest-rated item concerned laboratory practical work (M = 1.55, SD = .76), indicating that hands-on activities were, comparatively, the least problematic aspect of learning Physics for these students.

Table 5

Challenges Faced by Students in Learning Physics (N = 100)

Item	Mean	SD
Difficulty fully grasping Physics lessons.	2.91	.986
Difficulty comprehending procedures in Physics class.	2.75	1.167
Keeping difficulties to oneself rather than seeking help.	2.74	1.107
Preference for multiple-choice questions in exams.	2.74	.991
Insufficient time for revision before examinations.	2.67	1.035
Belief that tuition is necessary to excel in Physics.	2.66	.995
Difficulty revising the year's syllabus for final exams.	2.66	1.066
Difficulty with teachers' way of presenting topics.	2.64	1.087
Classroom questioning aiding understanding.	2.64	1.049
Difficulty completing homework independently.	1.94	.789
Difficulty expressing knowledge in short questions.	1.87	1.012
Anxiety as Physics examinations approach.	1.77	.777
Perception that exam time limits are too short.	1.67	.652
Difficulty with laboratory practical work and experiments.	1.55	.757

RQ3: Teachers' Strategies to Boost Students' Interest

Thematic analysis of the interview data identified six themes: (1) challenges in teaching Physics, (2) teaching approaches and curriculum materials, (3) understanding and

implementing student-centred learning, (4) the importance of active learning, (5) methods and techniques for active learning, and (6) teachers' perceptions of their own experience in enhancing student interest.

All three teachers reported that a shortage of functioning laboratory apparatus constrained their ability to conduct experiments comprehensively:

“Yes, because many apparatuses are damaged and cannot be used, which prevents experiments from being conducted comprehensively.” (Teacher 2)

Teachers also described a range of instructional approaches, from multimedia integration (“Video, simulation, notes” — Teacher 1) to student-centred activities incorporating problem-solving and PAK-21 (21st-century learning) techniques such as “roam the room” and “think-pair-share” (Teacher 2), and gallery-walk presentations in which student groups produced and presented conclusions on mahjong paper (Teacher 3). All three teachers affirmed the value of active, student-centred learning, but two of the three — both early-career teachers — expressed uncertainty about whether their own experience was sufficient to meaningfully boost student interest, citing a need for further professional development and, in one case, plans to develop supplementary learning applications.

Discussion

The finding that students rate the applied, real-world relevance of Physics content more highly than their general enjoyment of the subject echoes prior research linking interest to perceived relevance (Kurt, 2021; Sofna et al., 2023). Where Physics content is explicitly connected to everyday phenomena, student engagement appears to increase; where it is not, students report comparatively lower enthusiasm, even while acknowledging the subject's explanatory power.

The consistent identification of Physics as “the most difficult subject” aligns with a broad literature attributing this perception to the subject's heavy mathematical demands (Kedir & Wami, 2020) and abstract, decontextualised nature (Bouchée et al., 2022; Wangchuk et al., 2023). Notably, however, students did not rate Physics as boring, nor did they rate laboratory practical work as especially challenging — a pattern consistent with research emphasising the motivational value of hands-on, experiential activities (Lee & Sulaiman, 2018; Putri et al., 2017).

On the teaching side, the near-universal concern about laboratory apparatus shortages corroborates earlier findings that inadequate equipment constrains the implementation of practical, inquiry-based instruction (Chala, 2019). Since laboratory work is understood to serve both affective and skills-based goals in science education (Putri et al., 2017), this shortage plausibly limits teachers' capacity to translate a stated commitment to active learning into consistent classroom practice. The contrast between the veteran and early-career teachers in this study — with the more experienced teacher expressing greater confidence in applying experiential techniques — is broadly consistent with research linking teacher pedagogical content knowledge and experience to student motivation and achievement (Keller et al., 2016).

Collectively, these findings reinforce Dewey's proposition that interest is cultivated by deliberately linking subject content to real-world application (Opinaldo, 2022), and Piaget's emphasis on constructive, non-rote learning (Jarre, 2020), while also highlighting the structural constraints — chiefly resourcing — that can limit the practical realisation of these pedagogical principles in Malaysian secondary schools.

Implications

The findings carry implications for three groups of stakeholders. For teachers, results suggest value in deliberately foregrounding the real-world applicability of Physics content, and in using formative indicators of struggling or disengaged students to inform targeted support. For the Ministry of Education, findings point to the importance of continued investment in laboratory apparatus and infrastructure, alongside professional development opportunities that build early-career teachers' confidence in delivering active, student-centred instruction. For students, the findings underscore the value of self-awareness regarding one's own areas of difficulty — particularly foundational mathematics — as an entry point for targeted improvement.

Recommendations for Future Research

Several directions for future research follow from this study's limitations. A longitudinal design incorporating pre- and post-tests could track how students' perception and interest evolve over the course of their Physics education, rather than capturing a single cross-sectional snapshot. Extending sampling to Form 3 students, prior to their formal exposure to Physics, could help distinguish pre-existing dispositions from those shaped by classroom experience. Comparative studies across school types — urban versus rural, or government versus private institutions — and across gender could further illuminate disparities in interest and identify where targeted interventions may be most needed.

Conclusion

This study examined secondary school students' perception of, and interest in, learning Physics in Selangor, alongside the strategies Physics teachers use to sustain that interest. Findings indicate that students are more receptive to Physics when its content is explicitly linked to real-world phenomena, but that mathematical demands and difficulty in grasping lesson content remain persistent sources of disengagement. Teachers, for their part, expressed broad commitment to active, student-centred pedagogy — including PAK-21 techniques — but identified a shortage of functioning laboratory apparatus as a significant constraint on their ability to deliver hands-on, experiential instruction consistently. These findings suggest that improving student interest in Physics is unlikely to be achieved through curriculum or pedagogy reform alone; it will also require sustained investment in the material resources that make experiential, Dewey-informed teaching practicable in Malaysian secondary school classrooms.

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