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Students' Learning Styles and Their Relationship with Academic Achievement in Science

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Abstract

The study aims to identify the most dominant learning style among Form Two students and to examine the relationship between learning styles and students' achievement in the science subject. A survey-based research design was employed using a learning styles questionnaire based on a four-point Likert scale. Content validity was evaluated and analysed using the Content Validity Index (CVI), yielding a value of 0.94, indicating good validity. The reliability of the instrument was established through Cronbach's alpha, with a coefficient of 0.83. The questionnaire was administered to 103 students using a simple random sampling technique. Data were analysed using descriptive analysis (mean and standard deviation) and inferential analysis (Pearson correlation). The findings showed that the sociological learning style recorded the highest mean score (means = 3.02, standard deviation = 0.71), followed by emotional, psychological, environmental, and physical learning styles. Pearson correlation analysis indicated that all learning style dimensions were significantly and positively associated with students' science achievement ($p < .01$). These findings suggest that awareness of learning style preferences may help students adopt more effective learning strategies to enhance their academic performance.

Keywords: learning style, academic achievement, science education

1. Introduction

Students differ in the ways of receiving, processing and responding to information during the learning process. These differences play an important role in shaping learning effectiveness and academic outcomes [1]. In formal education settings, students' academic achievement is frequently used as a key indicator to evaluate the effectiveness of teaching and learning processes. This is particularly evident in science education, which requires conceptual understanding, higher-order thinking skills and the ability to integrate knowledge across multiple contexts [1, 2]. Consequently, understanding individual differences in how students learn has become increasingly important in efforts to enhance students' achievement.

One of the established frameworks for examining individual differences in learning is the Dunn and Dunn Learning Style Model [3]. This model conceptualises learning styles through five major factors: environmental, emotional, sociological, physical and physiological. Each factor encompasses specific elements that influence students' learning preferences. For example, the environmental factor includes sound, lighting, temperature and seating arrangement, while the emotional factor relates to motivation, responsibility, persistence and the need for structured learning. The sociological factor refers to learners' preferences for studying alone, in pairs, with peers, in teams, or with adult guidance, as well as their need for variety in learning situations. The physiological factor involves perceptual strengths (auditory, visual, tactile, or kinesthetic), patterns of food intake, preferred time of day for learning, and the need for mobility. Finally, the psychological factor reflects cognitive processing tendencies, including analytic versus global processing styles and reflective versus impulsive response patterns, which influence how learners organise and respond to information. The multidimensional nature of this model allows for a holistic examination of learning preferences within authentic classroom settings.

Recent empirical studies continue to demonstrate meaningful associations between students' learning preferences, engagement and academic achievement. Many studies suggest that instructional approaches aligned with learners' preferences can enhance motivation, improve classroom engagement and support better academic performance, particularly in cognitive-demanding subjects such as science [4, 5]. Conversely, mismatches between teaching strategies and students' learning preferences have been linked to reduced attention, lower motivation and weaker academic outcomes [6]. These findings highlight the importance of considering individual learning differences when designing effective instructional practices.

In response to these issues, this study aims to examine the relationship between students' learning styles and academic achievement in science, using the Dunn and Dunn Learning Style Model as the theoretical framework. By identifying dominant learning style factors and their association with academic performance, this study seeks to provide empirical insights that can inform instructional planning and pedagogical decision-making. The findings are expected to support teachers and school administrators in developing more responsive and inclusive science teaching strategies, ultimately contributing to improved academic achievement among school students.

Materials and Methods

Research Design

This study employed a quantitative research approach. Data were collected through a questionnaire to obtain information related to students' learning styles.

Population and sample

The population of this study consisted of 143 Form Two students from a school in Kota Bharu district, Kelantan, Malaysia, who were enrolled in the science subject. The sampling method used was a simple random sampling technique to ensure a fair and unbiased representation of the target population. A total of 103 respondents [7] participated in the actual study. Their science achievement records from the Early Year Assessment were identified before the data collection.

Research Instrument

The instrument used in the study was a questionnaire adapted from previous study [8]. The questionnaire consisted of two sections. Section A collected the respondents' demographic information, whereas Section B identified the respondents' learning styles. A 4-point Likert scale was employed in the questionnaire: 4 for "strongly agree," 3 for "agree," 2 for "disagree," and 1 for "strongly disagree." The questionnaire was validated by two lecturers from the Faculty of Science and Mathematics, Universiti Pendidikan Sultan

Idris. Additionally, a pilot test with 30 respondents was conducted to determine the reliability of the questionnaire.

Data Analysis

Instrument validity was evaluated using the Content Validity Index (CVI), while reliability was determined through Cronbach's alpha coefficient based on the pilot study findings. Data from the actual study were analysed using descriptive statistics, including means and standard deviations. Pearson's correlation coefficient was applied to examine the direction and strength of the relationship between learning styles and students' achievement in the science subject.

Results and discussion

The content validity of the questionnaire was assessed using the Content Validity Index (CVI), as presented in Table 1. The overall CVI value of 0.94 exceeds the recommended minimum of 0.80 [9], reflecting strong agreement on the relevance of the questionnaire items. This suggests that the items adequately represent the learning style dimensions proposed in Dunn and Dunn's Learning Styles Model. The reliability analysis based on the pilot study showed that the 48-item questionnaire achieved a Cronbach's alpha coefficient of 0.833, indicating good internal consistency. Within the framework of Dunn and Dunn's model, this suggests that the instrument measures relatively stable learner preferences rather than situational or transient learning behaviours, supporting its suitability for use in the actual study.

Table 1: Content Validity Index (CVI) of the Learning Styles Questionnaire

Expert	CVI value
Expert 1	0.92
Expert 2	0.95
Average	0.94

The descriptive statistics for the learning style constructs are summarised in Table 2. Overall, students demonstrated moderate levels across all learning style factors, with sociological learning style merging as the most prominent construct (means = 3.02, standard deviation = 0.71), followed by emotional, psychological, environmental and physical learning styles. Although the sociological learning style obtained the highest mean, all other constructs fell within the moderate level of interpretation based on the established criteria [10]. The predominance of sociological learning style suggests that students tend to prefer learning through interaction with peers, group activities and collaborative settings. This finding is consistent with the theoretical assertion that learning is enhanced when instructional conditions align with learners' social preferences [4, 11]. The relatively consistent spread of responses across all constructs further supports Dunn and Dunn's view that learners typically possess a profile of learning style preferences rather than a single dominant style. This reinforces the notion that learning styles operate along continua and may coexist depending on learning context and instructional design.

Table 2: Means and Standard Deviations of Learning Style Constructs

Learning style factor	Mean	Mean Interpretation	Standard Deviation	Standard Deviation Interpretation
Environmental	2.79	Moderate	0.517	Moderate
Emotional	2.84	Moderate	0.519	Moderate
Sociological	3.02	High	0.714	Moderate
Physical	2.78	Moderate	0.641	Moderate
Psychological	2.81	Moderate	0.701	Moderate

The correlations between learning styles and science achievement are presented in Table 3. All learning style constructs demonstrated significant positive relationships with science achievement. From the perspective of Dunn and Dunn's model, the stronger associations observed for sociological and physical learning styles suggest that students who prefer collaborative and hands-on learning approaches tend to perform better in science.

Table 3: Pearson Correlation between Learning Styles and Science Achievement (N = 103).

		Science Achievement
Environmental	Pearson Correlation	.409**
	Sig. (2-tailed)	< .01
	N	103
Emotional	Pearson Correlation	.348**
	Sig. (2-tailed)	< .01
	N	103
Sociological	Pearson Correlation	.550**
	Sig. (2-tailed)	< .01
	N	103
Physical	Pearson Correlation	.511**
	Sig. (2-tailed)	< .01
	N	103
Psychological	Pearson Correlation	.448**
	Sig. (2-tailed)	< .01
	N	103

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

These findings may also be interpreted through Kolb's Experiential Learning Theory [12], which emphasises learning through experience and active involvement. Kolb postulates that knowledge is constructed through a cyclical process involving concrete experience and active experimentation. Learning styles that favour physical engagement and social interaction closely correspond to these experiential modes of learning, which are integral to scientific inquiry, experimentation and problem-solving [6, 13, 14].

In contrast, the associations observed for environmental, emotional and physiological learning styles suggest that these dimensions function as supportive learning conditions. Within Dunn and Dunn's framework, such elements influence learners' readiness, comfort and motivation but may not independently drive academic achievement unless combined with experiential and interactive instructional strategies.

Overall, the findings provide empirical support for both Dunn and Dunn's Learning Styles and Kolb's Experiential Learning Theory, highlighting the importance of aligning science instruction with learners' preferred styles, particularly those emphasising collaboration and experiential learning.

Conclusion

This study investigated factors that influenced students' learning styles and their relationship with science achievement. The findings indicate that students exhibit diverse learning style preferences across multiple factors, supporting the view that learning styles are multidimensional and may coexist rather than function as fixed categories. The significant associations between learning styles and science achievement suggest that alignment between instructional approaches and students' learning preferences is relevant to academic performance. Learning styles emphasising social interaction and physical engagement appear particularly compatible with the experiential and inquiry-based nature of science learning. In conclusion, the study underscores the importance of adopting flexible, learner-centred instructional strategies that accommodate diverse learning styles to support science learning.

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