

SCORE Overview: Programming and Computational Thinking in Vocational Landscape

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Abstract

The increasing complexity of the digital economy underscores the need for vocational students in Malaysia to develop strong programming and computational thinking skills. To address this, it is essential to create effective screening tools that can accurately measure these competencies during the admissions process. This concept paper applies the SCORE Analysis Model, encompassing Strengths, Challenges, Options, Response, and Effectiveness. It represents as a strategic framework for developing and implementing such screening tests within vocational education. The paper begins by examining the strengths of current educational practices and assessment methodologies, particularly those grounded in psychometric principles. It then identifies the challenges associated with measuring programming and computational thinking skills, including the need for valid and reliable instruments, the integration of these assessments into existing curricula, and the variability in student preparedness. Drawing from these insights, the paper explores a range of strategic options to address these challenges, such as the development of adaptive testing methods, the use of digital platforms for assessment, and collaboration with industry partners to ensure relevance and rigor. The response section outlines a targeted strategy for the development and validation of the screening test, ensuring it leverages identified strengths while addressing the critical challenges. Finally, the effectiveness of this approach is evaluated through measurable outcomes, including the reliability and validity of the screening test, student performance metrics, and alignment with industry standards. The SCORE framework thus offers a comprehensive approach to the strategic development of educational measurements, providing a pathway to enhance the selection process for vocational education and better prepare students for the demands of the technology-driven workforce.

Keywords: SCORE Analysis Model, Vocational Education, Programming, Computational Thinking, Measurement

Introduction

In the rapidly evolving digital economy, the demand for specialized skills in programming and computational thinking is not only significant but crucial for meeting industry needs (Aguilar Espinosa, 2023; TADEU & BRIGAS, 2022). As modern industries continue to integrate technology-driven solutions, the ability to think computationally and perform complex programming tasks has become an essential determinant of success across a broad range of sectors (Proctor, 2023; Wing, 2014). This growing reliance on technology has amplified the need for workforce competencies in these areas, particularly in vocational education. Vocational education, designed to equip students with industry-specific technical skills, faces the challenge of ensuring that incoming students possess the foundational knowledge necessary for success in these rigorous, tech-intensive programs (Fatah et al., 2024; Jamaludin et al., 2023; Mohd Nong & Md Osman, 2024).

The importance of addressing this challenge lies in the increasing complexity of programming, and the highlights of computational thinking skills in 21st century learning, which are now seen as important in across various sectors including manufacturing, healthcare, finance, and information technology. For students entering vocational education, early identification of their readiness in these key areas is pivotal. Yet, traditional admissions processes often overlook these specific skills, relying instead on broader academic metrics that may not reflect the nuanced abilities needed for success in programming and computational tasks (Luesia et al., 2023). Therefore, developing more effective and targeted screening tools becomes essential—not just for the success of students, but also for the sustained relevance and competitiveness of vocational programs in the global workforce (Zhang & Neitzel, 2024).

The study of such screening tools is vital for multiple stakeholders. For educational institutions, it allows for better alignment between student capabilities and program requirements, improving both retention and completion rates (Daniels et al., 2019; Winkler, 1987). For students, it ensures a more appropriate match to their skills, reducing the risk of failure or frustration in tech-driven educational pathways. Industry benefits from this process as well, as better-prepared graduates are equipped with the practical, relevant skills needed to contribute immediately to the workforce. Thus, the development of robust screening mechanisms has broad implications, impacting not only individual student outcomes but also institutional effectiveness and industry alignment.

However, the creation of these screening tools is fraught with challenges (Zhang & Neitzel, 2024). The process includes by ensuring that they are valid, reliable, and seamlessly integrated into existing educational frameworks. A strategic approach is required for varying levels of student preparedness while ensuring that the tools developed are adaptive and capable of evolving alongside technological advancements. Several types of strategies planning tools are SWOT, TOWS, NOISE and SOAR (Neal, 2023). A frequently utilized tool for strategic planning is the SCORE Model. Table 1 briefly explains the strategies planning tools.

This paper proposes the application of the SCORE Analysis Model. It encompassing Strengths, Challenges, Options, Response, and Effectiveness as a comprehensive framework for the development and implementation of screening tests in vocational education (Ford et al., 2024). By systematically analysing the strengths of existing educational practices and

identifying the challenges associated with measuring programming and computational thinking skills, this model facilitates the exploration of strategic options that can overcome these obstacles. The response phase of the model guides the targeted development and validation of the screening tools, ensuring that they are both robust and adaptable to various educational contexts. Finally, the effectiveness of these tools is assessed through measurable outcomes, including their reliability, validity, and alignment with industry standards.

Table 1

Understanding the strategies planning tools (Neal, 2023)

Strategy Planning Tools	
<i>SWOT</i>	<i>Basic. looks at an organization's Strengths, Weaknesses, Opportunities, and Threats. Essentially, it involves capturing a concise overview of the organization's strengths, areas for growth, opportunities, and potential obstacles.</i>
<i>NOISE</i>	<i>An upgrade to SWOT. Introduces extra elements that tackles the topics of New Opportunities, Improvements, Strengths, and Exceptions.</i>
<i>SOAR</i>	<i>It is about Strengths, Opportunities, Aspirations, and Results. It's like having a positive dream for the organization and working to make it real.</i>
<i>SCORE</i>	<i>It is like a guideline. It's about Strengths, Challenges, Options, Responses, and Effectiveness. It helps an organization make smart choices.</i>

In applying the SCORE framework, this paper aims to contribute to the strategic development of educational measurements within vocational education, offering insights that can enhance the selection process and better prepare students for the demands of a technology-driven workforce. The proposed approach not only addresses the immediate needs of vocational institutions but also aligns with broader educational goals of fostering a skilled and competent workforce equipped to navigate the complexities of the digital age. It is anticipated that this study will offer valuable insights and practical benefits to key stakeholders, including the Ministry of Education, vocational colleges, as well as educators and students involved in IT programs. Thus, the aim is to discuss the assessment based on strategies in programming and computational thinking in Malaysia using the SCORE Analysis.

SCORE Analysis Model for Strategy Based Assessment Tool

SCORE Analysis Model is a strategic framework designed to facilitate comprehensive assessments and informed decision-making within organizational, educational, and business contexts. Unlike traditional models such as SWOT (Strengths, Weaknesses, Opportunities, Threats), SCORE expands the evaluative scope by focusing on actionable responses and effectiveness, offering a more dynamic approach to addressing complex challenges. This model consists of five core constructs: Strengths, Challenges, Options, Response, and Effectiveness (Neal, 2024). Each construct is integral to the overall analysis and contributes to the development of strategic initiatives that can drive performance improvement. The SCORE model is often used in corporate and business contexts. In the context of education, the SCORE model has high potential to be used to consider strengths, challenges, options, response, and effectiveness.

SCORE Analysis Model is the most action oriented. Whilst SCORE takes a more positive, smart choices and action-oriented approach than SWOT (Neal, 2023). It leads through potential obstacles and encourages you to generate responses for them. It helps an organization make smart choices. By incorporating elements such as 'Options' and 'Response,' SCORE encourages proactive strategizing and continuous improvement. In educational contexts, the SCORE model can be utilized to design and assess curricula, develop educational technologies, and improve instructional methodologies. Its structured approach allows educators and administrators to systematically identify areas of strength and challenge, explore various pedagogical options, implement targeted responses, and evaluate the effectiveness of these interventions through measurable outcomes.

This literature review explores the development and application of the SCORE model, delving into each construct's theoretical underpinnings and practical implications, particularly in the context of educational measurement and assessment. Each construct is integral to the overall analysis and contributes to the development of strategic initiatives that can drive performance improvement. Figure 1 represents the SCORE Analysis Model.

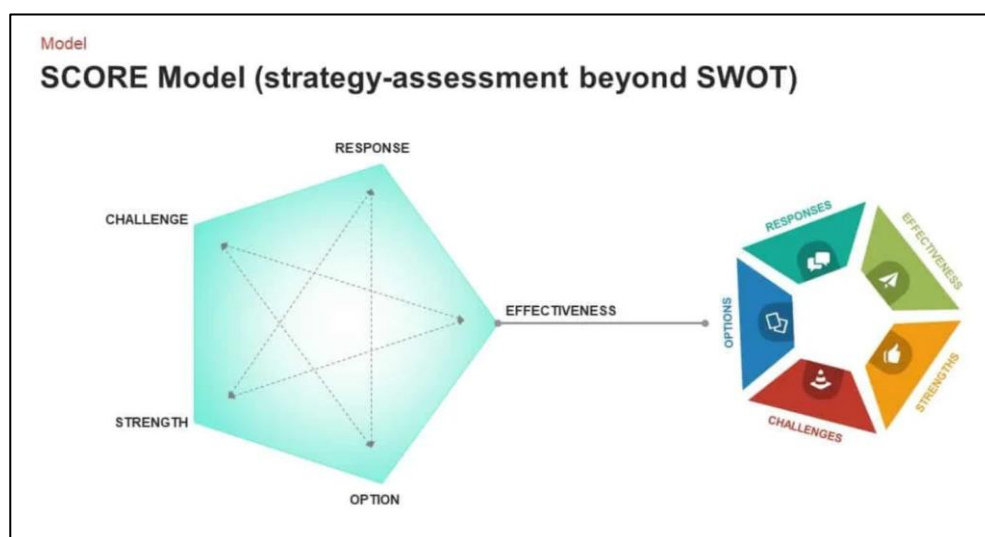


Figure 1: SCORE Analysis Model

Strengths

Strengths refer to the internal attributes, resources, and capabilities that provide an advantage or beneficial impact on achieving desired outcomes. Identifying strengths is crucial as it allows organizations or projects to leverage existing competencies and assets effectively. The concept aligns with resource-based theories which posit that sustainable competitive advantage stems from unique resources and capabilities. In educational settings, strengths could include experienced faculty, robust curricula, advanced technological infrastructure, and supportive institutional policies.

When developing screening tests for vocational education, strengths may encompass the existing expertise in test development, availability of validated assessment frameworks, and prior successful implementations of similar tools. Recognizing these strengths facilitates building upon proven strategies and methodologies, ensuring a solid foundation for new

assessment instruments. Studies have shown that acknowledging and leveraging institutional strengths lead to more effective educational interventions (Nieuwerburgh & Green, 2022). For instance, utilizing experienced educators in test development processes enhances the quality and relevance of assessment tools (Makgamatha, 2022). Additionally, integrating established psychometric principles ensures the reliability and validity of educational measurements (Qizi, 2024)

Challenges

Challenges denote the internal and external factors that may hinder progress or adversely affect the achievement of objectives. Identifying challenges is essential for proactive problem-solving and strategic planning (Hassan et al., 2024). Challenges are often analysed through the lens of constraint theory, which focuses on identifying and addressing limiting factors to improve performance and outcomes (Stefanov et al., 2022). In the context of educational assessment, challenges could involve resource limitations, diverse learner backgrounds, and rapidly changing technological demands. Developing effective screening tests may face challenges such as ensuring cultural and linguistic appropriateness, maintaining test security, adapting to varied educational standards, and addressing potential biases. Recognizing these challenges early enables developers to design mitigating strategies and enhance the assessment's fairness and effectiveness. Research highlights that common challenges in educational assessments include aligning tests with learning outcomes and industry requirements (Lee & Kim, 2019), as well as ensuring accessibility and inclusivity for all students (Garcia, 2020). Addressing such challenges is critical for the validity and acceptance of the assessment tools.

Options

Options involve the exploration and identification of various strategies, approaches, and alternatives to leverage strengths and address challenges effectively. This construct encourages creative and comprehensive thinking in strategy development. Option generation is rooted in decision-making theories, particularly those emphasizing rational choice and scenario planning. Considering multiple options allows stakeholders to evaluate potential pathways and select the most effective and feasible strategies. In developing screening tests, options may include different assessment formats (e.g., multiple-choice, performance-based tasks), delivery methods (e.g., online platforms, paper-based tests), and scoring techniques (e.g., automated scoring, human raters). Evaluating these options involves assessing their alignment with educational objectives, resource requirements, and stakeholder needs. Studies demonstrate that exploring a range of assessment options leads to more robust and adaptable testing solutions. For example, incorporating adaptive testing technologies can enhance efficiency and accuracy in measuring student competencies (Ma et al., 2023). Collaborative development approaches, involving educators, industry experts, and psychometricians, have also been identified as effective options for creating relevant and valid assessments (von Davier, 2017).

Responses

Response pertains to the selection and implementation of specific strategies and actions derived from the evaluated options. It represents the actionable phase where plans are put into practice to achieve desired outcomes. The response phase aligns with implementation, focusing on translating strategies into effective actions and ensuring fidelity to planned

interventions. Effective responses are characterized by strategic alignment, resource optimization, and adaptability to feedback and changing conditions. Selecting an appropriate response involves choosing the most suitable assessment design and implementation plan based on thorough evaluation. This could involve developing a pilot test, training administrators and educators, and establishing protocols for administration and scoring. Effective responses also include contingency plans to address unforeseen issues during implementation. Successful implementation of educational assessments often involves iterative processes, where initial responses are refined based on pilot results and stakeholder feedback (Young, 2022). Effective responses are also characterized by strong project management and continuous monitoring to ensure objectives are met (Dao & Khanh, 2023).

Effectiveness

Effectiveness involves evaluating the outcomes of the implemented strategies to determine their success in achieving the intended goals. This construct emphasizes the importance of assessment and feedback in the strategic planning process. Effectiveness assessment is grounded in evaluation theory, which involves measuring outcomes against predefined criteria and standards to inform future decision-making and continuous improvement. Evaluating the effectiveness of screening tests entails analysing data on test reliability, validity, predictive accuracy, and fairness. It also includes collecting feedback from stakeholders and examining the impact on student selection and subsequent performance in vocational programs. Effective evaluation processes inform refinements and adjustments to the assessment tools and processes. Research underscores the importance of ongoing effectiveness evaluations to ensure assessment tools remain relevant and accurate over time (Berman et al., 2024).

Summary

These results indicate that the application of the SCORE Analysis Model provides a structured and effective approach to developing and implementing screening tools for vocational college admissions, particularly in assessing programming and computational thinking skills. Due to practical constraints, this paper does not provide a comprehensive review of the SCORE model in all its potential applications. Instead, the study focuses on the strategic use of the model within the specific context of educational measurement and the development of admissions screening tests. This finding has important implications for the refinement of admission processes in vocational education, suggesting that a targeted, strategic approach can significantly enhance the accuracy and effectiveness of student selection. Besides that, this finding could help in optimizing educational outcomes by ensuring that students who are most likely to succeed in technology-driven fields are identified early in the admissions process. By understanding the strengths and challenges within this framework, we can properly identify the key factors that contribute to successful implementation and continuous improvement of screening tools. Future studies on the current topic are therefore recommended. Further research could extend to exploring the broader applicability of the SCORE model in other educational contexts or disciplines, as well as investigating the long-term impacts of these screening tools on student performance and career readiness in the digital economy. Figure 2 provides a concise summary of how SCORE Analysis Model applies specifically to the development and implementation of a screening tool in this concept paper.

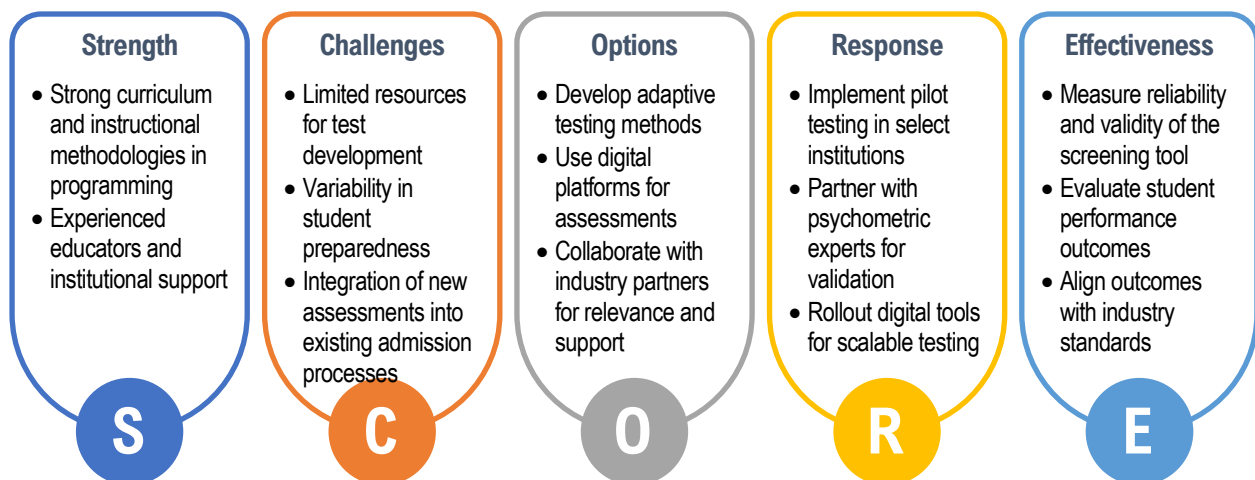


Figure 2: SCORE Analysis Model for Screening Tool in Programming

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