

Optimizing Manipulative Skills Development: The Odyssey with Score Model Assessment

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Abstract

The development of manipulative skills is an essential element of secondary education, especially in STEM subjects (science, technology, engineering, mathematics) and vocational education, as these skills improve students' cognitive, psychomotor and problem-solving abilities. Despite their importance, these skills are often undervalued in the Malaysian education system, with more emphasis being placed on science process skills. This paper explores the application of the SCORE (Strengths, Challenges, Options, Responses, and Effectiveness) model as a strategic tool to assess and promote the development of manipulative skills among students in Malaysia. Using a theoretical analysis, the study evaluates curriculum guidelines, teacher preparation, and resource allocation to understand the challenges and opportunities in improving these skills. The major findings suggest that the SCORE model offers a structured, action-oriented approach for identifying key strengths, such as the inclusion of hands-on learning in the Malaysian curriculum and the expertise of qualified teachers. However, the study also highlights significant challenges, including disparities in resource availability between urban and rural schools, as well as an over-reliance on technology, which may detract from fundamental hands-on skill development. *The limitations of the study are the exclusive focus on the SCORE model, which may overlook complementary instruments such as SOAR or NOISE, and the lack of empirical data, as the research is largely theoretical.* The implications of this research suggest that adopting the SCORE model could lead to more targeted and effective interventions, thereby enhancing educational outcomes. Future research is recommended to conduct empirical studies and longitudinal assessments to measure the SCORE model's long-term impact on students' performance and readiness for the workforce. Additionally, combining the SCORE model with other assessment frameworks may provide a more holistic approach to skill development.

Keywords: Manipulative Skills, SCORE Model, Planning Tool, Strategy, Decision Making

Introduction

Developing manipulative skills is crucial in secondary education, especially in subjects such as science, technology, engineering, and mathematics (STEM), as well as vocational training. Manipulative skills, also referred to as psychomotor skills, involve the ability to interweave cognitive functions with corresponding physical movements (Kempa, 1986). These skills are essential for students to succeed in practical tasks and are directly linked to their cognitive and affective development. In Malaysia, the importance of manipulative skills has been increasingly recognized in educational policy and curriculum development. The Malaysian Ministry of Education emphasizes the integration of hands-on activities and practical assessments to ensure students are well-prepared for the demands of the 21st-century workforce.

In science, manipulative skills focus on the efficient use and control of scientific equipment and chemicals in hands-on lab work (Engku Mohd Sharul Akimi & Mohd Effendi @ Ewan, 2024). Students will also be familiarized with proper techniques for safe use, cleaning, and storage of scientific equipment. The inability to acquire scientific manipulative skills may hinder the acquisition of other desired skills. For example, if students have difficulty operating a piece of equipment, it may interfere with their ability to make important observations and collect relevant data (Hidayah & Rohaida, 2014). Ministry of Education of Malaysia (2017) emphasizes that manipulative skills are psychomotor skills when students conduct scientific investigations consisting of the following five elements:

1. Use and handle science equipment and materials properly
2. Handle specimens properly and carefully
3. Sketch scientific specimens, materials and equipment accurately
4. Clean science equipment properly
5. Store science equipment and materials properly and safely

Unfortunately, the significance of development of manipulative skills among students is not much discussed in Malaysia as the focus is more on science process skills. The positive exploration of the significance of developing manipulative skills with an action-oriented approach helps in organizing strategic planning, especially in decision making. One of the strategic planning tools that is often used is the SCORE model. In addition to the SCORE model, there are many other tools such as SWOT, TOWS, NOISE, SOAR and many more (Neal, 2024).

However, SCORE has the advantage of taking a more positive and action-oriented approach compared to SWOT. Therefore, the aim of this concept paper is to describe the strategy-based assessment in the development of manipulative skills among students in Malaysia using the SCORE model.

SCORE Model – Strategy-Based Assessment/Strategic Planning Tool

The SCORE model (Strengths, Challenges, Opportunities, Responses, and Evaluation) has been proposed as a more versatile alternative to the commonly used SWOT strategy-assessment framework. Developed initially for use in organizational settings, the SCORE model has been adapted for educational purposes to provide a more holistic evaluation of

student performance. The model offers a structured approach to assess not only what students know but also how they apply their knowledge and skills in practical situations. When this analysis tool is performed after a detailed insight into the reality of the organisation, it provides a positive outlook that effectively summarizes the results of the analysis ((Neal, 2023).

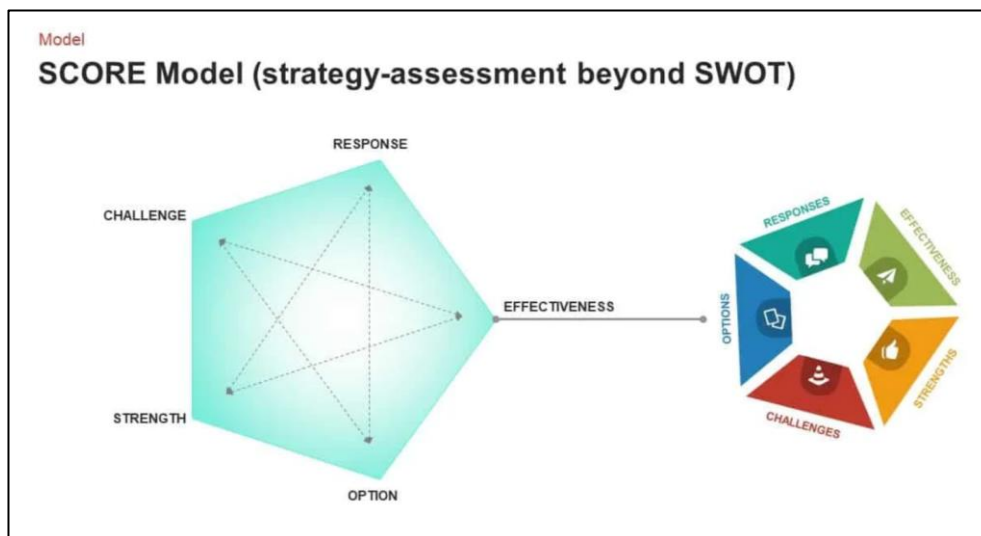


Figure 1: SCORE Model as Strategy Assessment

The application of the SCORE model in assessing manipulative skills involves several steps that correspond to its components. Strengths (S) represent what you do well (or have the potential to do well); Challenges (C) represent the areas where you need additional resources or skills to succeed; Options (O) represent the opportunities and risks you face; Reactions (R) represent stakeholder responses and the returns or rewards you expect; and Effectiveness (E) represents the way you intend to implement your initiative efficiently and reliably. By following this framework, educators can create a more balanced and comprehensive assessment process that addresses both the psychomotor and cognitive aspects of learning. In this article, SCORE is used rather than SWOT because the environmental factors of the SWOT matrix are oversimplified in some cases and the results may even be far removed from reality (Taherdoost & Madanchian, 2021).

The SCORE analysis undoubtedly proves to be a valuable tool for organisations. As it encompasses a comprehensive and systematic approach to business valuation, it helps decision makers to make informed decisions. The emphasis on both internal and external factors ensures a holistic understanding of the organisation's current situation and the opportunities and challenges it faces. As a result, the SCORE analysis enables companies to leverage their strengths, overcome challenges, seize opportunities and take appropriate action to realize the organisation's vision.

Strengths in Development of Manipulative Skills

In assessing the strengths in developing manipulative skills among students in Malaysia, it is critical to consider the resources, services and skills available both within the education system and from external partners. This assessment helps to identify what works well and how to use it to improve student learning outcomes.

One of the key strengths in developing manipulative skills among Malaysian students is the emphasis on practical and hands-on learning approaches in the national curriculum. The integration of subjects such as science, technology, engineering and mathematics (STEM) emphasizes experiential learning, which fosters the development of manipulative skills. In addition, many Malaysian schools have already established Technical and Vocational Education and Training (TVET) programs that provide a solid foundation for students' acquisition and enhancement of practical skills through well-designed workshops, labs and activities.

Another key strength is the commitment and skills of teachers, who are often well trained in practical pedagogy. Many educators in Malaysia have the necessary knowledge and experience to teach manipulative skills effectively, and they often bring innovative approaches to engage students. Nur Zaitul Akmar et al. (2022) state that teachers need to make plans before handling practical work to ensure its effectiveness. The availability of various teaching aids and materials tailored to the local context further supports these efforts.

The Malaysian education system has several services and opportunities that support the development of manipulative skills. Firstly, most of the schools are equipped with workshops and science laboratories where students can carry out hands-on activities. These facilities provide a favourable environment for learning and practicing manipulative skills. Secondly, teachers are trained through continuous professional development programs that include modules on practical teaching methods, classroom management and the use of educational technologies. This training ensures that teachers are well prepared to support students in developing manipulative skills.

Besides, the national curriculum integrates STEM and TVET subjects that are structured to include practical components. This ensures that students regularly participate in activities that require manual skills, such as laboratory experiments, technical drawing and practical engineering tasks. Plus, the availability of textbooks, digital resources and teaching materials tailored to the Malaysian context helps educators to effectively implement practical lessons and makes the development of manipulative skills more accessible and relevant.

In addition to internal strengths, Malaysian schools can also utilize external services to further enhance the development of manipulative skills. Industry partnerships that involve working with local industries, such as manufacturing, engineering and technology companies, can provide students with real-world learning experiences. These partnerships can provide internships, mentorship programs, and access to industry-standard equipment and tools. Besides, partnering with community organizations and non-governmental organizations that focus on education and youth development can provide additional resources such as workshops, training, and funding for materials and facilities. These organizations often offer innovative approaches and additional support that enrich the learning experience.

Higher educational institutions such as universities and colleges can be valuable partners, offering expertise, state-of-the-art facilities and opportunities for collaboration. They can help bridge the gap between secondary and higher education by providing students with

advanced manipulative skills and technologies. Moreover, support from government agencies (e.g. the Ministry of Education) and international agencies (e.g. UNESCO, UNICEF) can bring additional funding, teacher training programs and educational resources. These collaborations often help to improve curricula and ensure alignment with global best practices.

By leveraging internal strengths such as a supportive curriculum, qualified teachers and existing facilities, as well as external resources such as industry partnerships, community engagement and international support, Malaysian schools can effectively promote the development of manipulative skills among secondary school students. This comprehensive approach ensures that all students have the opportunity to acquire practical, real-world skills that are essential for their future academic and career success.

Challenges in Development of Manipulative Skills

The development of manipulative skills among students in Malaysia is influenced by several factors. One of the biggest challenges is the difference in resources and facilities between schools. The existence of a laboratory is something important in the successful implementation of practical work (Chala, 2019). Schools in rural or less affluent areas often lack modern tools and equipment necessary for effective practical education. This inequality leads to a gap in the quality of manipulative skills development between urban and rural students.

In addition, there are challenges related to collaboration with partners, suppliers and other stakeholders. For example, the procurement of quality teaching materials and equipment can be hindered by bureaucratic processes and limited budgets, affecting the availability and quality of resources. Furthermore, there is often insufficient coordination between educational institutions and industry stakeholders, leading to a mismatch between the skills taught and the skills needed in the world of work.

New skills and services are needed to address these challenges. Schools need better ways to integrate modern technologies and tools into the curriculum. This includes the acquisition of advanced laboratory equipment, vocational tools and digital resources that facilitate hands-on learning. In addition, there is a need for services that support the training and professional development of teachers in the effective use of these new tools.

Partnerships with industry and VET providers can also play a crucial role. These partnerships can provide students with real-world experience and access to industry standard tools, bridging the gap between classroom learning and practical application. Collaboration with suppliers is also important to ensure the timely and efficient delivery of educational materials.

Developing these new skills and services requires several specific skills. Educators must acquire the ability to integrate technology into their teaching practice and use advanced tools effectively. This includes familiarity with digital tools and educational software that can enhance hands-on instruction. In addition, there is a need for project management and procurement skills to manage the processes of procuring and maintaining educational

resources. Schools also need staff who are able to build and maintain partnerships with industry and other stakeholders to ensure that the curriculum remains relevant and aligned with industry needs.

Several measures are needed to develop these skills and services. Firstly, targeted training programs for educators should be implemented. These programs should focus on the effective use of new tools and technologies as well as innovative teaching methods that incorporate these resources. Secondly, investment in infrastructure and resources is crucial. Schools need financial support and strategic planning to modernize their facilities and acquire the necessary equipment. This includes building partnerships with industry to obtain donations or subsidized equipment. Finally, fostering collaboration between educational institutions, industry partners, and government agencies can help align educational practices with workforce needs. Joint initiatives and shared resources can close gaps and ensure that students are equipped with the skills needed for future success.

Options in Development of Manipulative Skills

The options are focusing on opportunities and options. There are several ways to improve the development of manipulative skills among students in Malaysia. Firstly, the integration of advanced technologies and digital tools into the curriculum presents a great opportunity. The emergence of virtual labs, simulation software and interactive learning platforms can provide new opportunities for students to practice and hone their manipulative skills. Secondly, partnerships with industry and vocational training centres provide students with access to real-world experiences and professional equipment, bridging the gap between classroom learning and industry standards.

Although these possibilities offer considerable advantages, they also entail certain risks. One risk is potentially unequal access to advanced technologies and resources, which can exacerbate existing inequalities between urban and rural schools. Another risk is the possibility of over-reliance on technology, which can lead to less emphasis on basic practical skills if not balanced with traditional hands-on education.

Overcoming the risks associated with these opportunities can also lead to new opportunities. For example, the challenge of unequal access to technology can drive initiatives to better allocate resources and support to underserved schools. This can lead to improved overall equity in educational resources and opportunities. In addition, the risk of overuse of technology presents an opportunity to develop hybrid teaching approaches that integrate both traditional and modern methods to provide a more balanced educational experience.

There are several ways to take advantage of these opportunities while managing the associated risks. Firstly, resource allocation should be improved by implementing strategies to ensure that advanced technologies and educational resources are equitably distributed among schools. This could include government funding, grants or donations from industry partners. In addition, a balanced curricula should be developed that incorporate both modern technologies and traditional hands-on skills. This approach ensures that students benefit from technological advances while gaining important hands-on experience.

Besides, another way to take advantages of the mentioned opportunities is by strengthen industry partnerships. Closer collaboration with industry and vocational centres could be encouraged to provide students with real-world experience and modern equipment. Furthermore, professional development must be implemented consistently by providing educators with ongoing training so they can effectively integrate new technologies into their teaching practices and maintain a balance between digital and hands-on methods.

Responses in Development of Manipulative Skills

In an effort to strengthen the development of manipulative skills among students in Malaysia, it is important to understand the stakeholder responses, regulations and laws that may arise. In addition, assessing the business value of each opportunity and risk can help in making the right strategic decisions. This section discusses the stakeholder reactions, regulations and laws that may arise and assesses the business value of each opportunity and risk.

Educational institutions such as schools and education authorities can support initiatives that integrate advanced technologies and enhance hands-on education. They could provide feedback on the effectiveness of new teaching methods and contribute to curriculum development. Meanwhile, industry partners such as companies and vocational training centres are expected to collaborate by providing resources, training programs and hands-on experiences for students. They can also provide insights into industry standards and requirements, helping to align educational practices with workforce needs. Plus, government agencies can support these initiatives through policy changes, funding and strategic plans. They could respond by enacting policies that allow for better resource allocation and professional development programs for educators. The study by Husaina et al. (2018) shows that the support of financial resources plays an important role in making learning a success.

Several regulations might arise in response to strategies aimed at improving manipulative skills. For example, in order to standardise educational resources, there could be new regulations to standardize the quality and specifications of educational resources and materials in schools. This will ensure that all students have access to quality resources. In addition, regulations could be introduced to govern the integration of new technologies into the curriculum and ensure that pedagogical practices remain consistent and effective. Regulations could be also required to mandate continuous professional development for educators to ensure that they are adept at using new tools and technologies.

However, the introduction of new or upcoming legislation can have several impacts. Firstly, it may improve resource equity in which laws that aim to standardize educational resources can help reduce inequalities between schools and ensure that all students have access to the tools and equipment needed for effective practical education. Plus, regulations that govern curriculum integration can lead to a more structured and effective use of technology in education, improving the overall quality of teaching and learning. Lastly, new professional development requirements can improve teacher accountability and ensure that they keep up to date with best practices and technological advances.

Evaluating the business value of each opportunity and risk is essential to deciding on the right strategic move. The opportunity to integrate advanced technology in schools can bring

business implication in which schools and educational institutions may need to invest in new technologies and training programs. This represents a business opportunity for technology providers and professional development organizations. In fact, the risk of unequal access to resources could have significant business implications, as addressing this risk could require additional investment in resource allocation and support for under-resourced schools. It creates a business need for equitable resource planning and funding strategies.

Effectiveness in Development of Manipulative Skills

In evaluating the effectiveness of the SCORE model in developing manipulative skills among students in Malaysia, several factors need to be considered to ensure that the approach is both comprehensive and practical. This includes assessing whether the model is efficient, reliable, elegant, appropriate and integrated into the educational context.

The evaluation should determine whether the use of the SCORE model maximizes resources and minimizes waste. An efficient model would ensure that resources such as materials, time and teacher effort are used optimally to achieve the best results in developing manipulative skills. For example, schools should use low-cost, locally available materials that simulate real-world applications to reduce reliance on expensive, imported equipment. By minimizing waste of material resources and instructional time, the model promotes a more streamlined approach to skill development and ensures that each activity directly contributes to learning objectives.

Reliability is a decisive factor in the assessment of educational performance. A reliable approach in terms of the SCORE model would be one that is predictable, consistent and self-correcting. This means that the methods used to assess manipulative skills should produce consistent results in different contexts, with different students, and over different time periods. For example, using standardized rubrics and criteria for assessing student performance on practical tasks ensures that all students are assessed fairly and objectively. In addition, the inclusion of self-correction mechanisms, such as continuous feedback loops and opportunities for students to learn from mistakes, increases the reliability of assessments.

Elegance in this context refers to clarity, simplicity, consistency and the ability to take human factors into account. An elegant SCORE-based assessment would be easy for both teachers and students to understand and implement. Assessment methods should be clearly defined, avoiding overly complex procedures that could confuse or overwhelm stakeholders. For example, using simple, clear instructions and maintaining consistent assessment criteria can make the process more user-friendly and accessible. In addition, an elegant model would consider human factors, such as different learning styles and levels of students, allowing flexibility in teaching and assessment approaches.

Appropriateness measures whether the SCORE model is consistent with the pedagogical goals and purposes of developing manipulative skills. The model should support and maximize these aims by promoting students' critical thinking, creativity and practical problem-solving skills. It should align with the national curriculum and educational standards in Malaysia, which emphasize preparing students for future academic and vocational careers.

For example, the inclusion of practical tasks relevant to local industry and community needs ensures that the skills taught are valuable and applicable in real-world contexts.

Integration is about creating and supporting synergy between all education systems to ensure that the assessment of manipulative skills is not done in isolation but is linked to wider learning objectives and strategies. An integrated approach would ensure that the development of manipulative skills is aligned with other subject areas such as science, technology and mathematics, creating a multidisciplinary learning experience. This could include collaborative projects that require students to apply their manipulative skills in different contexts to reinforce the practical application of what they have learned. In addition, integration into the school system would include the involvement of various stakeholders such as teachers, administrators, parents and industry partners to support and enhance the learning process.

Figure 2 is the SCORE framework model for developing manipulative skills, showing the aspects that need to be strengthened through interventions as part of a holistic approach. What we can learn from this framework is that the SCORE will help to monitor the development of grit in the future, especially in an educational context.

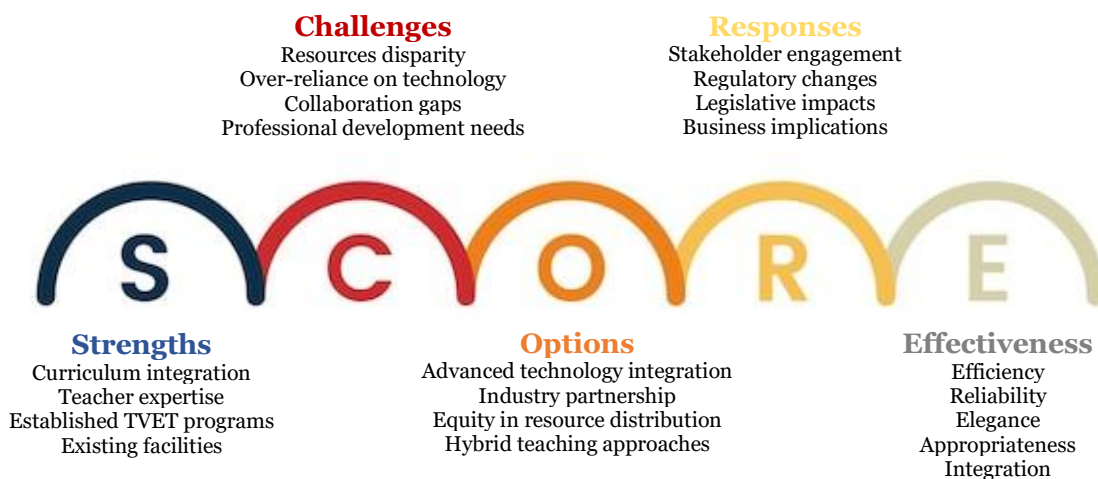


Figure 2: SCORE Framework Model on Development of Manipulative Skills

Summary

Overall, strategy-based assessment in the development of manipulative skills in students shows that it has a high potential when an effective strategy is well organized. It is not only beneficial to the country's education sector, but also has a good impact on stakeholders and outsiders as it has a high economic value. However, due to practical constraints, this concept paper cannot provide a comprehensive overview of the development of students' manipulative skills in Malaysia. This is because the SCORE analysis is more of a positive analysis of the strategy. This can be improved by using other models in the analysis, such as the NOISE model, the SOAR model or the SWOT model. The use of the SCORE model in strategy-based assessment to develop students' manipulative skills in Malaysia has important implications from both theoretical and practical aspects. Theoretically, this model enriches the literature by providing a systematic analytical framework for the assessment and

improvement of students' manipulative skills. It adds a strategic dimension to studies of manipulative skills and helps to understand how students can build their skills in a more structured and targeted way. In practice, this model provides teachers and administrators with clear guidance for identifying strengths, overcoming challenges, and implementing effective interventions. It helps to make more informative decisions to improve students' manipulative skills while strengthening the effectiveness of educational programs in schools. Future studies on the current topic are therefore recommended. Further study could extend to conduct longitudinal studies that explore the long-term effects of using the SCORE model in skill development and assess the impact on students' academic achievement, engagement, and career preparation over time.

Contribution

This paper makes a significant contribution to the field of educational assessment by applying the SCORE model (Strengths, Challenges, Opportunities, Responses, and Evaluation) to the development of manipulative skills among secondary students in Malaysia. By providing a structured and comprehensive analysis, this study highlights the under-explored area of manipulative skills, which are crucial for students' success in practical tasks, particularly within STEM and vocational education. The paper also bridges the gap between theoretical assessment frameworks and practical implementation, offering actionable insights for educators, policymakers, and stakeholders. Furthermore, the identification of strengths, challenges, and opportunities within the Malaysian educational context paves the way for more targeted interventions and policy reforms. This research not only enriches the existing literature on educational strategy and skill development but also sets the stage for future studies to explore the long-term impact of strategic models like SCORE on student outcomes.

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