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SOARing toward Scientific Literacy: A Strategic Model for Empowering Science Learning

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Abstract

Scientific literacy is a crucial competency in the 21st century, enabling individuals to apply scientific understanding to real-world contexts and make informed decisions. However, discussions on advancing scientific literacy through the SOAR model remain limited compared to other strategic planning frameworks. Therefore, this concept paper aims to describe a strengths-based strategic framework for promoting scientific literacy in Malaysia using the SOAR model. SOAR focuses on four key dimensions: Strengths (S), Opportunities (O), Aspirations (A), and Results (R), emphasising collective visioning and positive transformation rather than deficit analysis. The findings highlight that the SOAR framework offers a systematic approach for leveraging Malaysia's existing strengths in science education—such as global benchmarking (PISA, TIMSS), inquiry-based pedagogy, and digital innovation—while capitalising on opportunities in curriculum reform, regional collaboration, and technological integration. The aspiration is to nurture ethically grounded, critically thinking, and scientifically literate citizens aligned with Shared Prosperity Vision 2030 (Wawasan Kemakmuran Bersama 2030) and global sustainability goals. The expected results include improved student performance in scientific reasoning, enhanced teacher professionalism, and stronger public trust in science. This study has important implications for policy alignment, teacher education, and curriculum transformation in fostering critical and functional scientific literacy. Future studies could evaluate other strategic models such as SWOT, TOWS and NOISE which offer different analytical perspective and strengthen the conceptual justification of this paper.

Keywords: SOAR, Scientific Literacy, Science Learning

Introduction

In this modern era, our societies face increasing challenges such as misinformation, socio-scientific controversies, and declining trust in science (Lederman et al., 2025; Osborne & Allchin, 2024). All these issues highlight not only knowledge deficits but also a lack of reasoning, evaluation and evidence-based decision-making skills. The term scientific literacy has evolved from its early emphasis on factual understanding to include functional, critical and global dimensions (Guerrero et al., 2025). This broader conception of scientific literacy acts as a key competency for informed participation in modern societies, demanding learning environments that emphasize inquiry, reflection, and relevance over rote memorization.

In the Malaysian context, developing scientifically literate citizens is central to the Education Blueprint 2013-2025 and nation's goal of advancing STEM capacity (Mohammad Salleh & Halim, 2023). As our country transitions towards an IR 4.0 economy, pupils must not only understand scientific concepts but also apply them creatively and ethically in real contexts (Noor, 2021). Despite curriculum reforms, teachers often remain content-driven and examination-oriented, limiting the opportunities for inquiry and higher-order thinking. Re-envisioning scientific literacy should align with global agendas such as SDG 4 (Quality Education) and UNESCO's Future Education initiative, which emphasize sustainability, equity and lifelong learning.

The SOAR model (Strengths, Opportunities, Aspirations and Results) is a strategic framework roted in appreciative inquiry that emphazizez what organisations do well and how they can build towards a desired future (Stavros & Hinrichs, 2009). Unlike deficit-based model such as SWOT, SOAR focuses on mobilising existing strengths and shared aspirations to achieve meaningful, measurable outcomes. Hence, this concept papet aims to conceptualise a strengths-based strategic framework for advancing scientific literacy in Malaysia using the SOAR model. The scope of the study is confined to a conceptual analysis tather that empirical testing, offering a structured perspective on how SOAR can guide future-ready science education. Through a coherent progression from global challenges to national needs and finally to the strategic framing of the problem.

SOAR Model Assessment – Strategic Planning Tool

SOAR: A new approach to strategic planning," published in 2003, has a potent technique for strategic planning. It stands for strengths, chances, aspirations, and results, assisting firms in making the most of their advantages, investigating fresh prospects, establishing challenging objectives, and producing measurable outcomes. The philosophy behind the S.O.A.R framework is an appreciative inquiry, used to formulate plans that are aligned with the planned insights (Aziz et al., 2019).

SOAR model also applied worldwide. For instance, Kumar et al. (2023) utlised the SOAR model to evaluate undergraduate students' perseptions of e-learning and e-module in India. In business and marketing context, Diyasa et al. (2023) applied SOAR analysis to develop marketing strategies for an Integrated Online Smart Parking System. Putri & Pertiwi (2025) recently analyze and describe the public information disclosure strategy through the Information and Documentation Management Officer (PPID) of East Java Province using SOAR analysis. The SOAR Analysis Model can be illustrated as in Figure 1.0 as below:

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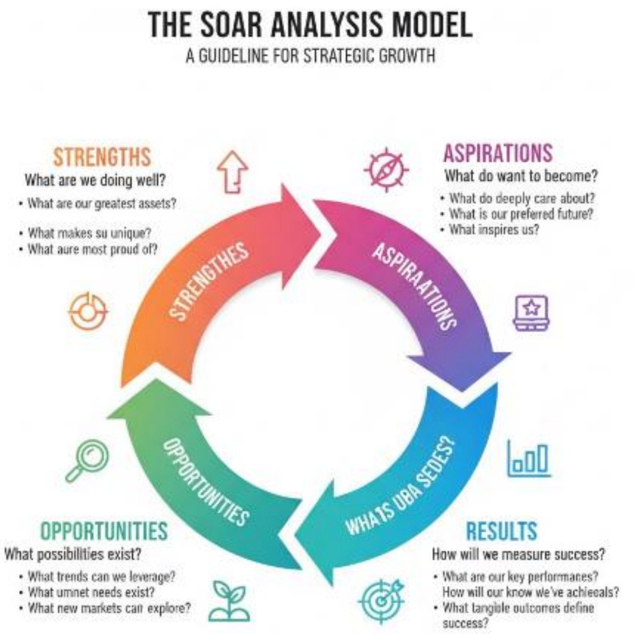

Figure 1.0: SOAR Model Assessment Framework

In the SOAR matrix, strengths are the foundational elements that set a research apart. These are internal attributes that contribute to its competitive research advantage. Identifying and leveraging strengths is crucial for a successful SOAR action plan in research. These are the internal attributes, capabilities, or resources that give an organization a competitive advantage or contribute to its success. Identifying strengths helps organizations understand what they do well and what sets them apart from others in digital era (Elgahwash et al., 2023). Opportunities, in the SOAR Matrix, Recognizing and capitalizing on opportunities is key to staying agile in research and responsive to the education market dynamics. Aspirations encompass the visionary goals and ambitions that guide a research towards future success. In the SOAR matrix, this part is about picturing what the educational organization (schools, HEI, etc) wants to achieve and deciding where it wants to go for growth. Results in SOAR analysis focus on the positives and measurable outcomes in your research topic. This involves evaluating the effectiveness of strategic initiatives and ensuring that the organization (schools, HEI, etc) achieves its objectives.

SOAR has been contrasted to the classic SWOT diagnostic analysis that diverts organizational resources away from strengths and opportunities by a focus on weaknesses and threats. Rather, SOAR is a dialogue-based (Cole et al., 2022). It has been demonstrated that S.O.A.R. is a flexible and successful strategic framework that fosters innovation, energy, and organizational engagement. Strength, Opportunity, Aspiration, and Result are the acronyms for S.O.A.R. A dynamic, contemporary, and creative method for developing strategic thinking, assessing individual and group performance, developing strategies, and formulating plans is S.O.A.R's strategic thinking and strategic planning.

S.O.A.R. is a framework that emphasizes the development and application of positive strategies through the identification of strengths, chances for constructive creativity, encouraging individuals and groups to share goals, and determining quantifiable and significant outcomes. Thus, strategic planning is accelerated by this approach. The Strength, Opportunities, Aspirations, and Results (SOAR) analytical approach has gained popularity as a planning and analysis tool for strategic initiatives over the past ten years. By applying this technique to identify environmental correlations, a firm can engage with its surroundings and establish business strategy. For more than 20 years, SOAR has established a reputation as a framework that provides a flexible way to think strategically and develop strategies (Muhammad & Hromada, 2023).

Organizations have found success using the S.O.A.R. Model to improve student performance, motivation, and engagement while facilitating change and development. The S.O.A.R. framework's goal is to accomplish the product target management aspiration by using the strategic planning approach based on the development of opportunities and strengths. In order to create plans that are in line with the planned insights, the S.O.A.R. framework is based on an appreciative inquiry. The analysis integrates the group's thoughts and promotes cooperation inside the company.

The S.O.A.R framework also provides a flexible approach to strategic thinking, planning and leadership that invites the entire system into a strategic planning or strategy process by incorporating all who have an interest in the future success of the organisation. These stakeholders can be internal workers such as employees or external such as suppliers, consumers, and societies. SOAR (Strengths, Opportunities, Aspirations, Results) analysis is an appreciative inquiry tool that is uniquely tailored to enable strategic planning around well-defined goals. SOAR analysis differs from the well-known SWOT (strengths, weaknesses, opportunities, and threats) analysis within two dimensions; it focuses on the future prospects and results from a subject of interest while SWOT aims at inherent weaknesses and perceived threats (Kumar et al., 2023).

S – Strength

In this modern era, one of the major strengths in contemporary science education is the existence of international frameworks that can guide global benchmarks for scientific literacy level among students. PISA 2025 Science framework highlighted that scientific literacy is the capacity to engage with science-related issues and ideas as reflective citizens, emphasising competencies such as explaining natural phenomena scientifically, evaluating inquiry designs, and interpreting evidence for decision-making (OECD, 2023). TIMSS 2023 also highlights the importance of integrating inquiry and reasoning in real-life contexts. By doing this, we can evaluate students' ability to apply scientific understanding to authentic problems (Centurino & Kelly, 2023). Both frameworks serve as powerful instruments for curriculum alignment, and the most important is to promote cross-national comparability and evidence-based policymaking, reinforcing science education as a catalyst for sustainable development and informed citizenship.

Besides these frameworks, pedagogical innovation is another key strength that drives towards scientific literacy. Inquiry science education has demonstrated its effectiveness in fostering students' critical reasoning, moral awareness and evidence-based decision-making (Bossér, 2024). The same goes for immersive technologies, such as virtual reality (VR), which has expanded students' capacity to apply knowledge in realistic and interactive contexts. Maimatayeva et al. (2025) reported that students' scientific literacy level increases by using VR-based biology lessons. STEM-based teaching approach that combines constructive inquiry and formative assessment to strengthen students' conceptual understanding and problem-solving skills (Parno et al., 2024). These pedagogical approaches mark a paradigmatic shift from rote learning to experiential, inquiry-driven and ethically responsive science education.

O – Opportunities
Now, Malaysia is at a crucial juncture to reimagine our science education in alignment with the global vision of Education 2030 and SDG 4. The progress of learning ecosystems- powered by virtual reality (VR), artificial intelligence (AI), and open educational resources (OER)- presents an unparalleled opportunity to democratise access and tailor science education. The integration of technologies in education, like artificial intelligence (AI), virtual reality (VR) and gamification into science classrooms aligns with global trends that emphasise immersive, interactive and inquiry-based learning (Maimatayeva et al., 2025; Othman & Ching, 2024). These technologies offer Malaysia the opportunities to develop applied and reflective science learners who can critically analyse and address real-world problems. Furthermore, the Twelfth Malaysia Plan emphasises STEM Socioeconomic Resilience, which encourages cooperation between industries, universities, and school in creating learning ecosystems that suits scientific literacy within sustainable innovation, environmental ethics and community well-being.

Malaysia's curriculum transformation also offers another opportunity to strengthen the connection between scientific literacy and everyday life through contextual, values-driven education. Research from Bossér (2024) and (Atias, 2024) showed that the incorporation of socio-scientific issues in classroom discourse can foster students' capacity to engage with moral, environmental and civic dimensions of science-skills necessary for addressing local and global challenges such as climate change, health literacy and technological ethics. The revised Kurikulum Standard Sekolah Rendah (KSSR) and Kurikulum Standard Sekolah Menengah (KSSM) already emphasise inquiry and problem-solving (Guerrero et al., 2025) to cultivate learners who can interpret information, challenge misinformation and act with informed trust (Osborne & Allchin, 2024). Hence, if we can align classroom practice with the PISA 2025 competencies, which encompass explaining phenomena, evaluating inquiry, and using evidence for decision-making, the national education outcomes and global benchmarks will be strengthened, positioning Malaysian students to thrive as globally competent citizens.

In the Malaysian context, our country stands at the forefront of cross-national collaboration in science education through initiatives such as the Belt and Road Science Education Network and the ASEAN Education Partnership (Malkawi, 2022). These collaborations provide Malaysia a unique platform to exchange innovations, harmonise science literacy standards and promote research-based pedagogical practices among neighbouring countries. Locally, Transformasi Sekolah 2025 (TS25) introduces professional learning communities (PLC), and Malaysia's Teaching Institutions provide the opportunity to empower educators as agents of change in cultivating scientific literacy. Malaysia can enhance its capacity for knowledge transfer and educational leadership by integrating research, reflective practice, and digital tools into teacher training. Hence, these opportunities —technological, curricular, and collaborative — can position Malaysia to operationalise the SOAR model in a way that transforms science education from content mastery toward functional, ethical, and globally relevant scientific literacy.

A – Aspirations

Malaysia's aspiration to enhance scientific literacy aligns with global calls for transformative, justice-oriented, and contextually relevant science education. Guerrero et al. (2025) reported that the national vision extends beyond fostering knowledge acquisition to cultivating critically global functional scientific literacy that empowers learners to act ethically, think critically and engage collectively in addressing local and planetary challenges. The Malaysia Education Blueprint (2013-2025) and Shared Prosperity Vision 2030 share the aspiration to nurture citizens who can navigate environmental crises, technological transformations, and socio-scientific controversies through informed judgment and intercultural understanding. This vision is aligned with Vision III of scientific literacy (Sjöström, 2025) which repositions science education as an avenue for ethical, socio-political, and relational engagement, allowing learners to see science not merely as a body of knowledge but as a shared human endeavour interwoven with justice, sustainability, and democratic participation.

In the pedagogical aspect, Malaysia aspires to reimagine science classrooms as a transformative space where inquiry, dialogue and trust form the foundation of learning. Based on Osborne & Allchin (2024) twenty-first-century scientific literacy requires individuals to become "competent outsiders"- citizens capable of evaluating the credibility of scientific claims and exercising informed epistemic trust. This vision resonates deeply with Malaysia's multicultural context, where diverse communities must navigate scientific information across languages, beliefs and digital platforms. By embedding socio-scientific inquiry (Bossér, 2024), functional reasoning and gamified or immersive learning experiences (Othman & Ching, 2024) Malaysian science education can cultivate reflective, responsible and resilient learners. In this aspiration, teachers act as facilitators of epistemic agency, guiding students to question, connect, and co-create scientific meaning that is both personally relevant and socially impactful.

Finally, Malaysia's SOAR-driven goal envisions scientific literacy as a unifying force for national and global well-being- a literacy that transcends examination boundaries to shape sustainable futures. This goal echoes Hazen et al. (1992) call that "science matters" because it equips citizens to make informed choices in a complex world. Research in Malaysia (Noor, 2021) shows that while students demonstrate conceptual understanding, their evaluative and interpretive competencies remain underdeveloped, highlighting the need for a functional and ethical dimension of literacy. Thus, through the SOAR framework, Malaysia aims to integrate its strengths (pedagogical innovations) and opportunities (regional collaboration and digital transformation) into a strategic direction where science education serves as a vehicle for civic empowerment, sustainability, and informed trust in science, reflecting both local values and global aspirations.

R – Results

The final outcome of Malaysia's SOAR-based transformation in science education is multidimensional- spanning learner development, teacher professionalism and systematic reform. At the learner level, the aim of our education system is to develop and cultivate functionally and critically scientifically literate citizens who can explain phenomena scientifically, evaluate inquiry, and interpret data for evidence-based decision-making (OECD, 2023). To achieve this outcome, it is necessary to develop measurable competencies aligned with the PISA 2025 Science Framework, enabling Malaysian students to apply scientific reasoning in authentic contexts rather than merely recalling fragmented facts. Noor (2021) highlighted that, Malaysian students demonstrated moderate conceptual knowledge but struggled with higher-order reasoning and evaluation, suggesting the need for continuous assessment systems that measure functional literacy performance rather than focus on memorising facts. Therefore, a tangible result of this SOAR initiative would be the integration of school-based literacy indicators within Pentaksiran Bilik Darjah (PBD) system, focusing on inquiry, argumentation and socioscientific reasoning.

At the teacher and pedagogical level, our aim includes strengthened teacher epistemic capacity and pedagogical resilience. Bossér (2024) pointed out that teachers who incorporate socio-scientific issues demostrate greater adaptability and reflective practice in supporting student engagement and value-based reasoning. In Malaysia context, initiatives such as Transformasi Sekolah 2025 (TS25) and Professional Learning Communities (PLC) provide fertile ground for embedding these inquiry-based competencies into classroom culture. The expected result is a corps of science educators who act as change agents—capable of guiding students through uncertainty, encouraging empathy in scientific debates, and facilitating inquiry anchored in evidence and ethics. Moreover, the expansion of digital tools, such as gamified learning (Othman & Ching, 2024), will contribute to measurable improvements in students' motivation, participation, and collaboration, outcomes that can be captured through classroom observation rubrics and digital analytics aligned with the Malaysian Teacher Standards (Standard Guru Malaysia 2.0).

At the systemic and societal levels, Malaysia's aspirations translate into measurable policy, partnership, and impact outcomes. Participation in regional collaborations such as the Belt and Road Science Education Network offers a platform for benchmarking Malaysia's progress and fostering transnational research on functional scientific literacy. By aligning local curricula with global standards such as PISA and UNESCO's Education for Sustainable Development (ESD) goals, the Ministry of Education can monitor tangible impacts—such as improvements in science literacy rankings, cross-disciplinary curriculum coherence, and community engagement in citizen-science initiatives. Ultimately, the expected long-term result is the emergence of a science-literate society that values sustainability, innovation, and trust in science. Through this SOAR-driven transformation, Malaysia positions science education not merely as an academic pursuit but as a strategic national investment—producing citizens who are informed, ethical, collaborative, and globally connected.

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Table 1
SOAR Analysis of Scientific Literacy Development in Malaysia

S – Strengths	O – Opportunities	A – Aspirations	R – Results
• Alignment with international benchmarks (PISA 2025, TIMSS 2023) guiding inquiry-based science learning. • Innovative pedagogies such as SSI-based inquiry (Bossér, 2024), STEM (Parno et al., 2024), and VR-based experiential learning (Maimatayeva et al., 2025). • Strong teacher education programs through IPG and TS25 initiatives emphasizing reflective and inquiry-based practice. • Cross-national collaborations (e.g., Belt & Road Science Education Network) enhancing research and resource sharing.	• Expansion of digital transformation through Malaysia Digital Education Policy (2023–2030). • Integration of AI, gamification, and immersive learning for engagement (Othman & Ching, 2024). • Curriculum innovation through SSI, ESD, and sustainability education. • Strengthening regional partnerships under ASEAN and Belt & Road for knowledge exchange.	• Reimagine science education as transformative, dialogic, and justice-oriented (Guerrero et al., 2025). • Develop critically and functionally literate citizens who act ethically and think scientifically. • Promote "informed trust" in science and empower students as competent outsiders (Osborne & Allchin, 2024). • Position Malaysia as a regional leader in advancing functional scientific literacy.	• Enhanced student performance in PISA domains (explaining, evaluating, interpreting evidence). • Teachers demonstrate inquiry-oriented, socio-scientific pedagogical practices. • Increased public trust in science and evidence-based civic participation. • Strengthened policy alignment with global education goals (SDG 4, ESD, UNESCO frameworks).

Conclusion

These results suggest that the SOAR model provides a powerful strategic framework for advancing functional and critical scientific literacy in Malaysia by leveraging existing strengths, seizing emerging opportunities, articulating national aspirations, and translating them into measurable educational outcomes. Due to practical constraints, this paper cannot provide a comprehensive review of SOAR; it focuses specifically on its application within the context of science education transformation and the development of a scientifically literate society. This finding has important implications for curriculum reform, teacher professional development, and policy alignment with global standards such as PISA and UNESCO's Education for Sustainable Development (ESD) goals. Furthermore, this finding could help guide educators and policymakers in designing more inquiry-driven, technology-enhanced, and socio-culturally responsive science learning environments. By understanding how the SOAR dimensions interconnect—Strengths, Opportunities, Aspirations, and Results—we can properly identify leverage points for improving both teaching quality and student scientific literacy outcomes. Future studies on this topic are therefore recommended; further research could include empirical validation of the SOAR framework in Malaysian classrooms, longitudinal assessments of literacy growth, and comparative analyses across ASEAN contexts.

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