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The 7E Instructional Model: A Contemporary Constructivist Framework for Enhancing Learning Outcomes in Science Education

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Abstract

The continuous growth in science and technology needs educational methods that can cultivate inquiry skills, conceptual understanding, and higher-order thinking skills in students. Conventional teacher-centred lecture methods are unable in promoting conceptual understanding. The 7E instructional model is a revised version of the 5E learning instructional model, which focuses on eliciting previous knowledge, active inquiry, scientific explanation, application, assessment, and transfer of learning. This paper consolidates the theoretical framework, origin of the 7E cycle, structural components, empirical data, and challenges in applications of the 7E instructional model based on published research. Researches shows that the 7E instructional model markedly improves student performance, inquiry abilities, motivation, and conceptual understanding in science education. Nonetheless, obstacles such as inadequate teacher training, restricted instructional time, budget limitations, and assessment concerns can impede effective adoption. Recommendations encompass capacity-building initiatives, curricular integration, technology-enhanced learning settings, and performance-based evaluations. The 7E instructional approach offers a strong, research-backed framework that matches with modern educational objectives and promotes active, inquiry-based, and transferable learning experiences.

Keywords: *7E Model, Constructivism, Learning Cycle, Inquiry-based Learning, Science Education, Student Achievement*

Introduction

In the 21st century, rapid growth in science and technology has changed the expectations of education systems worldwide. In today's time students must have ability to inquire, critical thinking skills, problem solving skills, and ability to apply their learning in real world setting rather than to acquire subject knowledge only. International reports of the National Research Council (2012) and OECD (2018) focused on a society where people are engaged in problem-solving, scientific reasoning, and adapting to new technologies. This change at the global level demands the adoption of instructional practices which promote higher-order thinking skills and avoid rote learning.

Still, there are many schools that rely on the traditional lecture-based method where students passively acquire knowledge. This teacher-centred pedagogy does not give students opportunities to ask questions, explore ideas, test hypotheses, or use previous learning in new settings. Research shows that this method is not helpful for correcting misconceptions, long-lasting retention, and higher-order thinking skills. As a result, students are unable to connect abstract concepts in real-life settings, which limits their achievement and enhancement of higher-order thinking skills.

To resolve these issues, constructivist approaches have been used in science education. Constructivist theorist Piaget (1972) and Vygotsky (1978) said that learning happens when students actively construct their own understanding based on their previous knowledge and social interaction. NCERT (2006, 2008) also focused on inquiry based, learner centred pedagogy. Further, constructivist theory led the development of learning cycle- starting from the 3E cycle (Karplus & Their) to the 5E instructional model (Bybee et al., 2006). Later, making this approach as a base, Eisenkraft (2003) proposed the 7E instructional model, which addressed two very important components often ignored in classrooms: eliciting previous knowledge and extending learning in real-life settings.

Theoretical Framework:

The 7E instructional model works on principles of constructivist learning theory, where learners construct their own knowledge by engaging in active learning where the learner learns from hands-on experience and the social circle around them (Piaget, 1952; Vygotsky, 1978). In constructivism, learners do not merely receive knowledge passively, but they build deep understanding through learning by doing, facilitated by meaningful, real-life-based tasks. In the 7E model learner also engaged in active participation which promotes inquiry through each phase, facilitating development of critical thinking and problem-solving skills (Bybee et al., 2006).

Mainly, constructivist theory is supported by Piaget’s cognitive developmental theory, which focus child development through different stage of cognitive development. Piaget theory highlight that learning experience of child should be aligned with child’s developmental level (Piaget, 1952). The 7E instructional model supports this idea by organizing different learning experience in seven phases to varying cognitive stages through progressively complex tasks (Bybee et al., 2006).

Further, Vygotsky’s sociocultural theory also supports 7E model by highlighting the role of social interaction in cognitive development. According to Vygotsky knowledge is constructed by collaboration and communication, this concept is reflected in the Explore and Elaborate phase of the instructional model where students work in group does experimentation, discussion and give feedback to each other (Vygotsky, 1978). This social element of learning enhances higher-order thinking skills and the depth of understanding.

Evolution of Learning Cycles

The evolution of learning cycle shows a huge time period researcher has spent on researching how students construct scientific understanding. Previously it was the 3E cycle – Exploration, Invention, and Discovery – as shown in the Science Curriculum Improvement Study (SCIS), introduced by Karplus and Thier, which was explicitly based on Piagetian ideas of cognitive development (Karplus & Thier, 1967; Marfilinda et al., 2019). Further, making this as a base, the BSCS team established the 5E Instructional Model—Engage, Explore, Explain, Elaborate, Evaluate - to provide a structured sequence that reveals misconceptions, directs research, and facilitates conceptual reconstruction (Bybee et al., 2006).

Later, research on the learning cycle transforms five phases of the learning cycle into a seven-phase learning cycle, which shows the need for two more phases, which cover the explicit elicitation of prior knowledge and the deliberate transfer of knowledge in a real setting. Eisenkraft (2003) introduced the 7E learning instructional model, incorporating Elicit and Extend to emphasise the need of starting with students' preconceptions and concluding with application in novel circumstances (Eisenkraft, 2003). Research on the learning cycle shows that the transition from 3E to 5E to 7E, which signifies an empirically supported improvement, aligns each new phase of the cycle more accurately with research on misconceptions, scaffolding, and transfer of learning, making 7E a comprehensive framework for inquiry-based science education (Marfilinda et al., 2019).

Structure of the 7E Instructional Model

The 7E Instructional Model is a systematic, inquiry-orientated teaching model which is designed to facilitate learners through deeper levels of cognitive engagement and understanding. The modification in phases of learning cycle over years address documented limitations in previous learning cycles, specifically, the lack of focus on misconception and real-life application. The model is structured into seven phases.

- Elicit – The elicit phase aims to focus on uncovering students' previous knowledge, misconceptions, and intuitive ideas. Teachers use techniques like questioning, concept maps, and prior-knowledge probes to understand students' starting points and prepare learners for further engagement (Eisenkraft, 2003).
- Engage – In the Engage phase, teachers aim to capture students' interest and activate curiosity. The teacher uses short activities, demonstrations, or real-life phenomena to connect previous knowledge to new knowledge (Bybee et al., 2006).
- Explore – The explore phase emphasises the investigation of materials, phenomena, or problems by students through experimentation and hands-on experiences. This phase helps students to build conceptual foundations and confront initial misconceptions (Noreen et al., 2024).
- Explain – During the Explain phase, learners articulate their understanding, while the teacher introduces scientific terminology or formal explanations to help refine and reorganise students' ideas (Bybee et al., 2006).
- Elaborate – In the elaborate phase, teachers encourage students to apply their new learning in different contexts, which strengthens conceptual transfer and deepens understanding through problem-solving and discussion activities (Marfilinda et al., 2019).
- Evaluate – In the evaluate phase, the teacher assesses the students' conceptual growth and skills through formative and summative techniques embedded throughout the cycle (Bybee et al., 2006).

- Extend – The last phase Extend where the teacher promotes the transfer of learning by challenging students to apply concepts in new settings. Eisenkraft (2003) added this phase to ensure learning beyond the lesson to real life setting.

All these seven phases are interconnected and establish a comprehensive, constructivist framework that provide inquiry, conceptual change and long-term retention.

Empirical Evidence: What Research Says About the 7E Model

Research on the 7E Instructional Model across multiple educational settings indicates positive effects of the 7E Instructional Model on student learning, but the nature and extent of the advantages of the model differ according to content area, implementation fidelity and nature of the learner. The research can be synthesised into key thematic domains: achievement, inquiry and process skills, conceptual understanding, and technology-enhanced learning.

1. Achievement and Performance Outcomes

Various quasi-experimental studies on the 7E instructional model show the significantly higher performance on the post-test compared to the traditional instructional methods. Noreen et al. (2024) found a statistically significant improvement in science achievement, with scores of the experimental groups higher than those of the control group.

However, short-term post-testing in the study raised the question of long-term retention and transfer of learning. Rahman and Chavhan (2022) also reported the improved academic performance; however, the small sample size and subjective evaluation restrain generalisability.

2. Inquiry Skills and Scientific Process Competence

Likewise, Vasudev and Patil (2024) reported enhanced integrated science process skills, including experimenting, observing, and inferring, suggesting that the cyclical, constructivist structure facilitates epistemic engagement. Nevertheless, both studies recognised that inquiry gains are dependent on teachers' proficiency with scaffolding.

Numerous studies suggest that 7E model helps in improvement of scientific inquiry more effectively than conventional method. Lubiano and Magpantay (2021) reported significant improvements in inquiry reporting skills.

3. Conceptual Understanding and Misconception Resolution

Researches also show development in conceptual clarity when learners migrate from traditional setting to exploration and elaboration. Warliani et al. (2017) found that students taught using the 7E model demonstrated deeper understanding of wave phenomena than those exposed to technology-supported lectures, highlighting the critical role of exploratory and explanatory phases. Yet, the study focused on a single topic, limiting disciplinary breadth.

4. Technology-Enhanced 7E Instruction

ICT-integrated 7E instructional model exhibits benefits, especially in visualising abstract concepts, but these outcomes may not be reproducible in low-resource settings, revealing contextual dependency. Warliani et al. (2017) found that students taught through a technology-supported 7E sequence showed higher conceptual understanding of mechanical waves compared to those who underwent standard instruction augmented with digital demonstrations, suggesting that 7E model-integrated use of ICT is more effective than isolated technology application.

Overall, it can be said that 7E Instructional model is effective for fostering inquiry-based and conceptually profound learning. Still, there are some limitations, such as context-restricted samples, variability in implementation fidelity, and limited longitudinal data.

Challenges in Implementing the 7E Model

Although the 7E instructional model is widely known for improving inquiry skills, conceptual understanding, and student engagement, still there are various challenges which limit the effectiveness of 7E instructional model in real classrooms. One of the most common hurdles is lack of teacher training. Many teachers are using lecture-based method and may they find it difficult to shift to a constructivist model, student-centred approach that needs designing open-ended activities, managing group work, and facilitating inquiry-based learning (Lubiano & Magpantay, 2021). Teachers often reported uncertainty about how to structure hands-on exploration tasks or how to guide students during inquiry without directly providing answers.

Time limitation is also a challenge for a teacher during the implementation of the 7E instructional model. The 7E model needs more time for experimentation and exploration, which are difficult to complete within limited class periods, especially in examination-based systems where teachers are needed to complete the syllabus within a limited timeframe. Studies such as Vasudev and Patil (2024) said that implementing all seven phases meaningfully demands more instructional time than traditional methods, making it difficult for teachers to cover the full syllabus.

Lack of resources is also a limitation. Inquiry tasks, simulations, and experiments used in different phases of the 7E instructional model may need a science lab, digital tools, or ICT access that many schools may not have much resources for, especially in rural schools. Warliani et al. (2017) found that there is improvement in understanding of students taught through technology-enhanced 7E lessons, but such resources are not available everywhere. Large classroom size is another limitation; it makes it difficult for teachers to manage group activities, monitor progress, and provide individualised guidance during the Explore and Elaborate phases. Additionally, students unacquainted with inquiry-based learning may initially find open-ended tasks challenging, necessitating supplementary scaffolding and time (Noreen et al., 2024).

Challenges in assessment also arise during the evaluation phase, which requires higher-order thinking skill tests rather than traditional tests. There may be lack of assessment tool to assess inquiry processes, creativity, and higher-order thinking. Despite of these challenges, Proper training, resources, and planning can be successfully integrate 7E instructional model to improve science learning at all levels.

Recommendations

Based on the reviewed studies, various recommendations can be given to make implementation of the 7E instructional model more effective. First, teacher training and professional development programmes should be organised. Teachers need support in planning inquiry-based group activities, facilitate student exploration, and integrate assessment across phases rather than at the end of instruction. Training modules should include demonstration lessons, collaborative planning, micro-teaching, and reflective practice, as suggested by Lubiano and Magpantay (2021).

Second, institutions should allocate sufficient instructional time to allow each phase-particularly Explore, Elaborate, and Extend—to occur meaningfully. Compressed implementation can weaken cognitive linking between phases; thus, school timetables may need flexible blocks or weekly cycle-based planning rather than daily content-completion pacing, as highlighted by Vasudev and Patil (2024).

Third, access to instructional materials and digital learning tools must be improved. Low-cost hands-on kits, virtual labs, and open-source simulations (such as PhET) can help overcome laboratory limitations. Warliani et al. (2017) demonstrated that technology-supported 7E instruction improves conceptual understanding, indicating that ICT resources should be integrated into science classrooms.

Fourth, curriculum planners and textbook authors should embed 7E-based learning sequences, guiding questions, activity prompts, formative assessments, and application tasks so that lesson planning is not solely dependent on teachers' personal expertise.

Fifth, students should be gradually orientated to inquiry-based learning, since some may initially prefer direct answers rather than exploration. Transition strategies such as scaffolding, think-pair-share, guided worksheets, and concept cartoons can support learners through the cognitive shift, as also noted by Noreen et al. (2024).

Finally, evaluation systems must include performance-based assessments, such as rubrics, portfolios, projects, and real-life problem-solving tasks, to accurately reflect the goals of the 7E model. Collectively, these recommendations can strengthen instructional practice and promote deeper, transferable scientific understanding through the 7E learning cycle.

Conclusion

Finally, it can be concluded that the 7E instructional model is a constructivist-based approach that effectively improves students' conceptual understanding, inquiry abilities, and achievement. Its reorganised structure, which begins with eliciting previous knowledge and last with transfer of learning to new setting, strengthens its ability to promote meaningful and long-term learning. Empirical studies show that the 7E model outperforms traditional lecture-based instruction, general inquiry models, and even the widely used 5E cycle, highlighting its advantage in scaffolding conceptual change and real-world application. Institutional support, professional development, curriculum alignment, and digital tool integration can address challenges related to training, time, and resources. In conclusion, the 7E model is not only relevant but essential for 21st-century science education, particularly in settings aiming to develop higher-order thinking and scientific literacy. Its implementation, when supported adequately, has the potential to transform classroom practice and enrich student learning outcomes.

References:

1. Bybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Powell, J. C., Westbrook, A., & Landes, N. (2006). *The BSCS 5E instructional model: Origins and effectiveness.* BSCS. https://www.bates.edu/research/files/2018/07/BSCS_5E_Executive_Summary.pdf
2. Eisenkraft, A. (2003). Expanding the 5E model. *The Science Teacher, 70*(6), 56–59.
3. Hersi, A. A. (2010). Darling-Hammond: The flat world and education: How America's commitment to equity will determine our future. *Journal of Educational Change*, *11*(3), 291-295. https://doi.org/10.1007/s10833-010-9137-7
4. Lubiano, M. L. D., & Magpantay, M. S. (2021). Enhanced 7E Instructional Model towards enriching science inquiry skills. International Journal of Research in Education and Science (IJRES), 7(3), 630-658. https://doi.org/10.46328/ijres.1963
5. Marfilinda, R., Zaturrahmi, & Indrawati, E. S. (2019). Development and application of learning cycle model on science teaching and learning: A literature review. *Journal of Physics: Conference Series, 1317*(1), 012207. https://iopscience.iop.org/article/10.1088/1742-6596/1317/1/012207
6. National Council of Educational Research and Training. (2006). *Position paper of the National Focus Group on Teaching of Science.*
7. National Council of Educational Research and Training. (2008). *National curriculum framework review report.*
8. National Research Council, Division of Behavioral, Social Sciences, Board on Science Education, & Committee on a Conceptual Framework for New K-12 Science Education Standards. (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. National Academies Press.
9. Noreen, Z., Iqbal, M., & Hayat, K. (2024). Effect of the 7E learning cycle model on students' achievement in the subject of science at elementary school level. *Qlantic Journal of Social Sciences, 5*(2), 34–45. DOI: 10.55737/qjss.315497375
10. Rahman, S., & Chavhan, R. (2022). 7E model: An effective instructional approach for teaching–learning. *EPRA International Journal of Multidisciplinary Research, 8*(1), 339–341. DOI: https://doi.org/10.36713/epra9431
11. The future of education and skills. (2018). *OECD Education Policy Perspectives*. https://doi.org/10.1787/54ac7020-en
12. Vasudev, R. K., & Patil, N. (2024). Programme based on 7E learning cycle to enhance integrated science process skills of secondary school students. *International Journal of Research and Analytical Reviews, 8*(4), 263–270. DOI: 10.13140/RG.2.2.13043.54565
13. Warliani, R., Muslim, & Setiawan, W. (2017). Implementation of 7E learning cycle model using technology-based constructivist teaching approach to improve students' understanding achievement in mechanical wave material. *AIP Conference Proceedings, 1848*, 050005. DOI: 10.1063/1.4983961