



Comprehensive Guided Inquiry Learning Model through Digital Concepts for Aquaculture Students: A Review

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Abstract

The abstract nature of the topics is easily understood while learning chemistry through guided inquiry. This article employs the A Review (SLR) technique to review eleven papers released between 2018 and 2023 that deal with teaching chemistry using various guided inquiry models. Three online article databases—ERIC, Scopus, and Google Scholar—were used to retrieve articles methodically. The information in this review will be helpful to educators and researchers who work in chemical education in understanding guided inquiry models, how they impact chemical learning outcomes, and how to apply them to improve students' comprehension of chemistry. The review's conclusions show how various guided inquiry strategies immerse students in a problem, offer them an investigation to work through and provide guidance on how to solve the problem. Guided inquiry models influence chemistry learning outcomes by enhancing metacognition, concept understanding, critical thinking skills, science process skills, learning outcomes, creative thinking abilities, and reducing misconceptions. Many learning models or strategies, including guided inquiry, guided inquiry-based on blended learning, guided inquiry-based on the flipped classroom, guided inquiry model integrated with STEM, and guided inquiry and task hierarchy analysis model in cooperative learning strategy, have also used different chemistry learning models.

Keywords: learning models/strategies, chemistry learning outcomes, guided inquiry model

Acknowledgments: Thank you to the Aquaculture Study Program, Universitas Nahdlatul Ulama Sumatera Barat, Padang, Indonesia for granting research permission.

For citation:

Megahati, R. R. P. & Yuliana, L. (2025). Comprehensive Guided Inquiry Learning Model through Digital Concepts for Aquaculture Students: A Review. *Journal of Digital Learning and Distance Education*, 4(7), 1786--1790. <https://doi.org/10.56778/Jdlde.v4i7.627>.

Introduction

The rapid growth of science and technology in this era of Industrial Revolution 4.0 demands the availability of top-notch human resources (Raja Santhi & Muthuswamy, 2023). Superior

education yields superior human capital. One of the government's endeavors to produce the highest level of human capital is the implementation of the 2013 curriculum. The 2013 curriculum emphasizes student involvement in the learning process heavily, emphasizing student-centered (or student-centered) learning. The goal of implementing the 2013 curriculum is to produce a generation capable of making contributions across multiple industries, one that is innovative, creative, and productive (Juliana et al., 2021). Education is one way to improve students' potential, skills, abilities, and will (Haleem et al., 2022).

Education may cause students to become more aware of and open to the ways that science and technology are evolving (Grassini, 2023). Chemistry is a branch of natural science that is derived and refined through experimentation to answer the what, why, and how questions regarding natural phenomena—particularly those about the composition, structure, characteristics, transformation, dynamics, and energetics of substances (Mao et al., 2023). In addition to its basic importance in understanding a wide range of natural phenomena, chemistry is essential to the advancement of knowledge in applied sciences such as technology, mining, agriculture, health, and fisheries, as well as other basic sciences like biology, astronomy, and geology. The goal of high school chemistry instruction, as stated in the 2013 Curriculum, is to assist students in becoming owners of both the knowledge and cognitive components. The knowledge dimension encompasses procedural, conceptual, metacognitive, and factual knowledge. The components of the cognitive process include remembering, comprehending, applying, analyzing, evaluating, and producing.

The application of the learning process of teaching chemistry in the field demonstrates this, based on the observation that teachers teach chemical concepts and theories through teacher-centered activities, but that students are not actively involved in these activities or given opportunities to develop their thought processes. Chemistry was a difficult subject, according to data from student observations and interviews, since many of the concepts were abstract and the teacher's chosen teaching style was less engaging (Barendsen & Henze, 2019); . The teachings have not been linked by the instructor to instances, events, or facts from the actual world. Students are only expected to accomplish untaught content, and they are expected to do so without help from the teacher. Furthermore, the KKM has maintained its student learning objectives for the past four academic years. Another problem is that chemistry teachers find it increasingly difficult to apply practical models and give pertinent material explanations. Using an inquiry-based learning method helps maximize the direct involvement of students in the learning process. Inquiry-based learning gives students more chances to study and conduct research in the same way that a scientist or researcher would (Becker et al., 2020). When inquiry-based learning is used, students have more opportunities to learn how to find facts, concepts, and principles through personal experience.

Methodology

A Review (SLR) methodology was used in this article. The process of conducting a systematic literature review, or SLR, follows accepted practices for locating and synthesizing relevant research publications and assessing the corpus of information about the topic of inquiry to locate the articles analyzed in this literature review, searches were conducted using the internet databases ERIC, Scopus, and SINTA (Indonesian Research Database).

Results and Discussion

The guided inquiry methodology for learning chemistry is defined

By addressing the what, why, and how of changes in matter's composition, structure, and properties as well as its dynamics and energetics, the field of chemistry seeks to explain natural phenomena. Process chemistry, or scientific work, and chemistry as a result of scientific discoveries, or chemical knowledge expressed as facts, concepts, laws, and theories, are two integral parts of

chemistry (Cornelio et al., 2023). Macroscopic, sub-microscopic, and symbolic are the three levels of understanding that comprise. The study of chemistry studies matters and its transformations. The macroscopic phenomena of matter can be revealed by its atomic or molecular structure and distribution, which is a representation of its sub-microscopic chemical properties. Students are compelled to ponder and undertake study because of the link among the three levels (Ho et al., 2023); (Sellars et al., 2018). Effective chemistry learning begins with appropriate activities; without them, beginning students may struggle (Raslan, 2023).

Learning Outcomes and the Impact of the Guided Inquiry Model

Critical thinking is a higher-order thinking skill. Understanding problems in-depth, being open to different points of view, and understanding the subject matter at hand are the objectives of critical thinking before making decisions in the classroom and daily life (Wilson, 2016); (Lombardi et al., 2021); (Darling-Hammond et al., 2020). Critical thinking skills include appraisal, self-control, interpretation, inference, analysis, and explanation, according to Facione. To effectively complete a range of academic examinations and to acquire life skills that will enable them to make decisions, kids must possess critical thinking abilities. Students who possess critical thinking skills generally make observations that question ideas with logical reasoning, draw analogies, provide guidance and criticism, disagree, think broadly or critically, and have strong problem-solving skills.

Learning about reaction rate chemistry is one way to improve your critical thinking skills. Pupils are instructed to use literature, conversation, and observation to gather data to construct plausible explanations (Ali et al., 2023). However, in actuality, there aren't many chemistry classes that emphasize critical thinking skills development and habituation. Critical thinking is one ability that students need to have to answer problems appropriately, especially when studying chemistry (Burhanuddin et al., 2019). Fischer explained that critical thinking is a subset of evaluative thinking that incorporates critical examination as well as creativity, especially when examining reasons that support a stance. According to Facione, there are six fundamental components to critical thinking. interpretation, inference, analysis, rationale, evaluation, and restraint. However, just four indicators—interpretation, analysis, inference, and explanation—are used in this study.

Applying the Guided Inquiry Model to Education

A common use of the guided inquiry paradigm in science-based chemistry education is shown in Table 2. The scientific method (SPS) abilities are prioritized when learning chemistry, as stated in Minister of Education Number 59 of 2014. One way to complete science-related tasks is through SPS. SPS allows pupils to absorb the content and draw connections between the ideas through activities or experiences. Moreover, SPS is a teaching approach that lets students investigate concepts via practical applications with real-world objects. Higher-order thinking is encouraged by SPS, which helps make learning experiences meaningful for pupils. Science process skills (KPS) are the cognitive, social, and motor skills that children acquire as a result of their basic abilities. According to (Senisum et al., 2022), students need to have adequate science process abilities to complete scientific inquiries. The guided inquiry model is one of the best teaching strategies for improving students' capacity for scientific inquiry.

Getting students involved in the scientific process as soon as possible is the aim of inquiry-based learning (Pedaste et al., 2015). Inquiry-based learning with guidance can enhance students' scientific comprehension while also fostering their creative thinking and advancing their information-gathering and analysis abilities, according to Schelenker's research findings reported in (Strat et al., 2023). Guided inquiry learning offers students more opportunities for hands-on learning. Given that it allows students to practice developing scientific thinking skills, this learning model may be a way to improve student learning outcomes and science process skills through direct learning experiences (Yunianti et al., 2019).

Conclusion

The definition of the guided inquiry model refers to the syntax in learning, which is based on a systematic review of the articles retrieved. It may also refer to other kinds of media, however, this particular kind of media integrates the study on a macroscopic, submicroscopic, and symbolic level. Among the benefits of incorporating the guided inquiry model into education include the enhancement of learning outcomes and the development of critical thinking, concept understanding, metacognition, science process, creativity, and general science abilities. Based on the research, information was also obtained that the guided inquiry model has been applied to several learning models/strategies such as Guided Inquiry Learning, Guided Inquiry-Based on Blended Learning, Flipped Classroom Based on Guided Inquiry Learning, Guided Inquiry Model Integrated with STEM, Guided Inquiry and Task Hierarchy Analysis Model in Cooperative Learning Strategy. The results showed that the application of guided inquiry models/strategies in learning effectively improved students' critical thinking skills and concept understanding.

Conflicts of Interest

No conflicts of interest

Author contribution

Ruth Rize Paas Megahati S contributed to conceptualization, methodology; Liza Yuliana contributed to software, validation, visualization, writing original draft preparation, and writing review and editing. The authors have read and agreed to the published version of the manuscript.

Declaration of Generative AI in Scientific Writing

The authors acknowledge the use of the generative AI tool Google translate-AI and Quillbot for grammar and language improvement. The authors are solely responsible for the content of the manuscript and have verified the accuracy, integrity, and originality of all AI-assisted outputs.

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