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Research Article

HOW TO IMPROVE PROBLEM SOLVING AND COMMUNICATION SKILLS OF PROSPECTIVE TEACHERS? A STUDY OF THE IMPACT OF RELIGIOUS INTEGRATION OF SCIENCE LEARNING

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Abstract
The purpose of this study is to analyze the impact of integrated science learning on improving problem-solving and communication skills of prospective teachers. The research method is a non-equivalent group design experiment. This study involved 95 prospective teachers from three universities in Java. Communication data was measured using an observation sheet and problem-solving data was measured using a descriptive test instrument. The instrument has been assessed by experts in the field of science learning. The 21-item descriptive test instrument meets the assumption of the mean square MNSQ fit models in the range of 0.77-1.33. The data collection techniques used were tests and observations. The instruments used were problem-solving tests and observation sheets. The data analysis techniques used were independent t-tests. The results of this study showed differences in problem-solving skills and communication skills of students who used modules and those who did not. Based on the significance value, it is concluded that there is a difference between the control class and the experimental class based on significance value < 0.05. The achievement of prospective science teachers is good. The aspects of understanding, planning, and solving problems are good. However, the evaluation thinking aspect is not optimal. The communication achievement skills of seven aspects, namely messages, message forms, channels, noise, context, impact, and ethics are good. Meanwhile, the competency aspect is not optimal.

Keywords: Communication, Problem Solving, Prospective Teachers, Religious Integration, Science Learning.

INTRODUCTION

Science teachers face the challenge of reconciling their acquired knowledge with the content found in textbooks and the contemporary understanding of specific issues in the field. Consequently, problem-solving and critical thinking are essential skills that prospective science teachers must develop,

as these abilities are crucial for analyzing facts and addressing problems (Ummah, 2019). Scientific inquiry can be conducted systematically through established procedures, with effective problem-solving being vital for tackling a range of scientific issues supported by empirical data and evidence(Cano-Moreno et al., 2022). Furthermore, exposure to real-life problems such as misconceptions in science or the application of scientific principles in society can enhance these problem-solving skills (Maruli et al., 2022).

Faculty can support this development by using participatory teaching approaches that incorporate factual learning materials. As preservice science teachers become more adept at connecting data with evidence, their analytical skills strengthen, ultimately enabling them to tackle complex problems (Suryadi et al., 2023). Additionally, communication skills are essential for success in the workplace, including for science teachers and scientists. Preservice science teachers must possess strong competencies in communication, which encompasses verbal, written, and nonverbal forms of expression. These skills are fundamental for effectively conveying and sharing ideas based on acquired knowledge. The nature of science involves four key elements: 1) attitudes, 2) processes, 3) products, and 4) scientific applications all of which should be communicated effectively through scientific communication skills (Ali, 2018).

Key components of communication skills include (1) the ability to comprehend key ideas from others, (2) the appreciation of different perspectives, (3) the capacity to formulate active assertions, and (4) the development of a shared understanding (Nurlaelah et al., 2020). Additionally, this research highlights six advanced learning skills related to scientific communication: scientific information retrieval, scientific reading, listening and observation, scientific writing, information representation, and knowledge presentation (Fadhila, 2022). Integrating science and religion is increasingly recognized as essential for addressing complex global issues and fostering a deeper understanding of the world and human nature. This scientific approach combines knowledge with religious beliefs, creating a holistic educational framework that enhances students' comprehension and application of both domains (Kloser et al., 2018). The goal is to ensure that scientific practices and advancements are guided by ethical and spiritual values, promoting sustainable and responsible progress.

In Indonesia, this integration is often facilitated in high school settings, particularly within boarding schools where religious activities are woven into daily life and general education (Arifah et al., 2022). Moreover, integrating science and religion could further enhance problem-solving and communication skills. While many studies have explored ways to improve problem-solving and communication skills primarily focusing on models and media(Machado & Carvalho, 2020). There is a notable lack of research on the integration of science and religion in educational modules for preservice science teachers. Therefore, this study aims to develop a module designed to enhance problem-solving and communication skills specifically for preservice science teachers. The primary objective is to assess the effects of this integration on the development of these essential skills among future educators.

There is extensive research on the integration of science and religion in science education, which is gaining increasing attention in educational research for various reasons. Emphasizing the development of preservice science teachers' problem-solving and communication skills within a cross-curricular context serves as a foundation for exploring the potential benefits of integrating science and religion in science learning (Erduran et al., 2019). For example, in the twenty-first century, applying an interdisciplinary perspective to integrate science and religion in daily life necessitates effective problem-solving. We need to quickly recognize the importance of an interdisciplinary approach to enhance problem-solving at personal, national, and supranational levels (Chan & Nagatomo, 2022).

Traditionally, religion and science are viewed as polarized due to their classic epistemic and ontological divides. However, both fields are underpinned by similar scholarly attitudes and share the overarching goal of nurturing a critical mind—one that is open to argument, evidence, and skepticism (Erduran et al., 2019). These commonalities have often been overlooked in comparison to their differences. While debates about their polarization and potential unification continue, the intersection of science and religion presents a compelling arena for research into problem-solving and the communication of knowledge. Therefore, integrating science and religion, particularly its role in promoting cross-curricular learning, can be effectively examined through problem-solving and communication skills (Park et al., 2022).

The role of educators in this integration extends beyond merely transferring knowledge; it also involves imparting moral and spiritual values, fostering students' character development, and guiding them through meaningful learning experiences. Educators can positively impact student learning and development by combining content knowledge, academic skills, and interactive techniques (Wu et al.,

2019). The integration of Islamic values into the classroom can be achieved by merging scientific concepts with Islamic teachings. Learning materials that incorporate these values can motivate students to change their thinking and behavior, making the educational process more valuable and meaningful.

An e-module is a type of teaching material presented in electronic format, designed to enhance student interest and motivation. Another perspective defines e-modules as systematic and engaging media that incorporate limitations, methods, and evaluation tools tailored to achieve desired 21st-century competencies (Maurer & Bogner, 2020). The characteristics of a good e-module are as follows: (1) self-instruction, meaning the instructions are clear; (2) self-contained, indicating it does not depend on other materials; (3) stand-alone, signifying that the content can be studied independently; and (4) user-friendly and adaptable, making it easy to use(Butler & Leahy, 2021). Furthermore, e-modules help reduce paper usage and enable students to access learning anytime and anywhere via computers, laptops, or mobile devices. Learning modules can enhance student competencies in schools with multiple shifts by extending available study hours. Additional advantages of e-modules include: (1) clarifying and simplifying teaching materials to reduce excessive verbal explanations; (2) boosting student motivation; (3) allowing students to learn at their own pace and according to their needs; and (4) enabling students to assess their skills through evaluations included in the e-module (Hadira et al., 2024).

Problem-solving skills involve applying existing knowledge while also creating new insights. This capability is crucial for successfully addressing different kinds of challenges. These skills should be considered cognitive abilities (Tenhovirta et al., 2022). Teaching students to recognize and tackle problems helps them develop important problem-solving skills. For preservice science teachers, mastering these skills is essential, as they begin their training as problem solvers from a young age. Real-world problem-solving skills can be cultivated by connecting classroom theories to real-life situations (Chung et al., 2022). Using learning modules in the classroom aims to bridge the gap between education and everyday life. By learning modules, students have the opportunity to identify, apply, and combine concepts to understand complex issues and devise innovative solutions to address them. Many studies have shown that modules surpass other types of modules in areas such as conceptual understanding, higher-order thinking skills, and design project activities (Sadikin & Hardianti, 2021). While these studies have created effective modules to engage and inspire students, the resulting modules are not particularly innovative or easily accessible.

Communication skills are essential in the 21st century. Communication encompasses reading, listening, and speaking abilities, making it vital for preservice science teachers (Nurlaelah et al., 2020). Therefore, developing preservice science teachers' communication skills should be a focus in the learning process. Effective communication between lecturers and preservice science teachers is crucial for optimal understanding of the material presented. Additionally, strong communication skills support preservice science teachers in achieving their learning objectives more effectively (Ntshwarang et al., 2021). Preservice science teachers can enhance their communication skills by providing feedback, sharing ideas and opinions, and asking questions when facing challenges. Communication can be categorized into two forms: verbal and nonverbal (Silveira et al., 2022). Verbal communication occurs through spoken and written means, while nonverbal communication includes gestures, body language, facial expressions, intonation, and language style. Indicators of verbal communication skills include engaging in discussions, presenting discussion outcomes, expressing opinions, answering questions, and documenting final results.

RESEARCH METHOD

This research is an experimental research. The experimental design used is a non-equivalent group design. This study involved 95 prospective teachers from three universities in Java. Communication data was measured using an observation sheet and problem-solving data was measured using a descriptive test instrument. The instrument has been assessed by experts in the field of science learning. The 21-item descriptive test instrument meets the assumption of the mean square MNSQ fit models in the range of 0.77-1.33 (Linacre, 2002). The reliability value is 0.7 and means it has a good reliability value. The observation sheet instrument was corrected by two experts with a level agreement score of 3.72 which concluded that two assessors agreed. The data analysis used was a one sample t test on problem-solving thinking data and communication skills.

RESULTS AND DISCUSSION

The study was conducted at three different Universities in Java and involved 95 prospective teachers. The study looked at the impact of science learning and its teaching modules with a science and

Qur'anic approach. Science learning is carried out by presenting problems related to science concepts, students in groups conduct investigations to answer the problem formulation and connect it with the concept of the Qur'an. The module is used by students to assist in investigation activities.

Problem-solving thinking skills and communication skills were measured at the first meeting and the final meeting. The data obtained were tested for normality and homogeneity. Normality and homogeneity data are presented in Tables 1 and 2.

Table 1 Data normality test

Variables	Data Group	Significance value	Information
Problem Solving Thinking	1	.39	Normal data
	2	.35	Normal data
	3	.69	Normal data
Communication Skills	1	.08	Normal data
	2	.24	Normal data
	3	.85	Normal data

Homogeneity test is conducted before hypothesis testing. Homogeneity test is conducted to ensure data between groups are homogeneous. The results of homogeneity test are presented in Table 2.

Table 2. Data homogeneity test

Variables	Levene Statistics	df1	df2	Sig.	Information
Problem Solving Thinking	.592	2	93	.61	Homogeneous data
Communication Skills	.573	2	93	.68	Homogeneous data

Based on the table above is a decision-making tool to conclude homogeneous/unhomogeneous data.based onsignificance value. If the significance value >0.05 then all data is homogeneous. Data significance valueproblem solving skills and communication skills >0.05 then it is concluded that the data is homogeneous and can be continued for testing.hypothesis. The independent sample t-test is presented in Table 3.

Table 3. Results of independent difference test t test

	F	Sig.	t	Df	Sig. (2-tailed)	Average Score	Std. Difference in Error	95% Internal confidence difference	
								Lower	Higher
Equation of assumed variation	.612	0.436	-23,678	66	0.00	-18,433	0.779	-19,985	-16,900
Unassumed variation equations			-23,678	65.65	0.00	-18,433	0.779	-19,985	-16,900

Based on the table above is a decision-making tool to conclude that there is a difference between the control class and the experimental class.based onsignificance value < 0.05.The achievement of preservice science teachers' is good. The aspects of understanding, planning, and doing problem solving are good. However, the aspect of evaluation thinking is not optimal. The achievement of seven aspects of communication skills, namely messages, message forms, channels, noise, context, impact, and ethics is good. Meanwhile, the competence aspect is not optimal. The achievement of problem solving and communication skills is presented in Figure 2 and Figure 3.

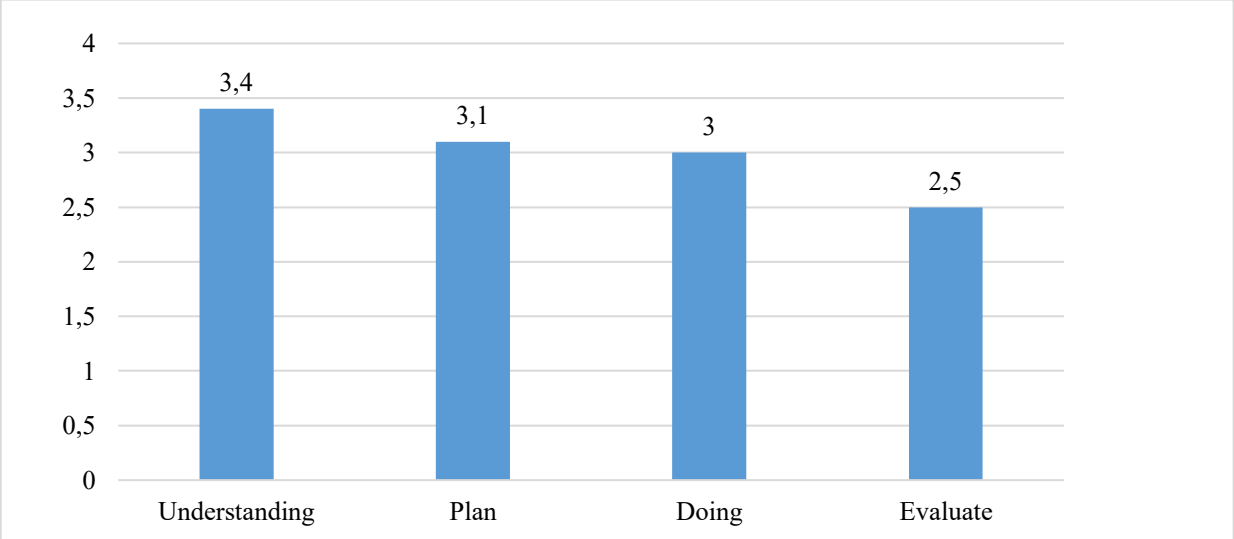

Figure 1. Problem solving skills

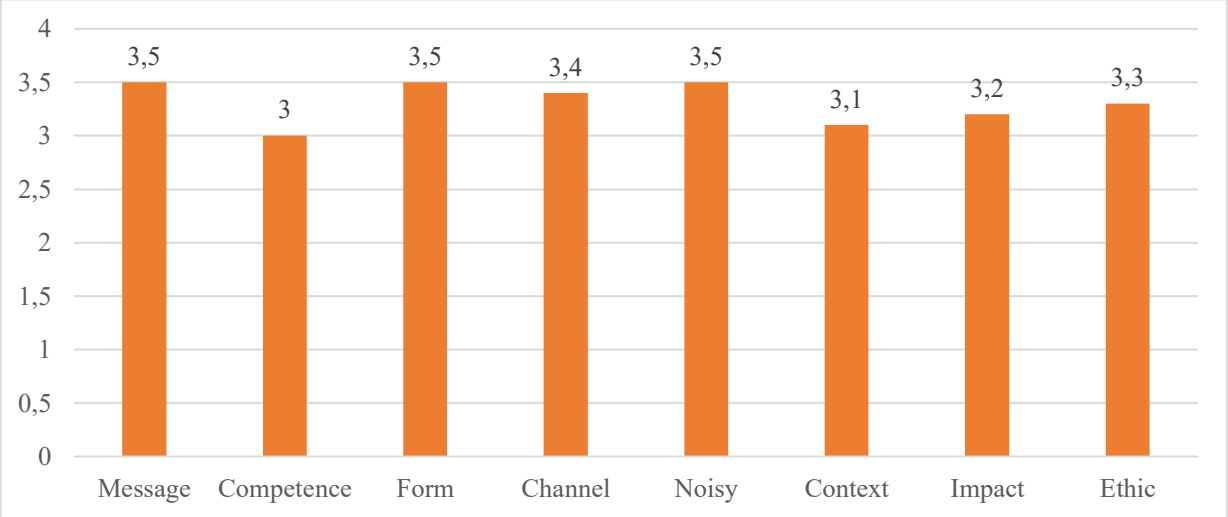

Figure 2. Communication Skills

Prospective teacher students follow the integrated science learning of religion. Topics of unit quantities, temperature and heat, motion and force, eco-systems and solar systems are connected with verses of the Qur'an. Prospective teachers in groups conduct investigations to find scientific concepts and the relationship between science and verses of the Qur'an. Investigation activities are thought to train problem solving because they have not found natural phenomena related to the proof in the verses of the Qur'an.Science learning based on the scientific method process of discovery, questioning, presentation, application and transformation of scientific knowledge trains individual problem solving. (Aksoy, 2005). Teachers can ask students to do independent research activities, or engage in divergent thinking training in science process skills. (Sternberg, 2003). Students are encouraged to develop science through scientific observation, classifying, asking questions, forming hypotheses, planning experiments, measuring, using equipment, and drawing conclusions from empirical data. (Cheng, 2011)**.**In addition, to prepare students to solve problems that are not only structured but also unstructured, complex and diverse, it is necessary to present problems found in everyday life in learning. (Dixon & Brown, 2012).

Views, opinions, attitudes and knowledge will be built by a person through interaction with the socio-cultural context in life history and interpreted as the religion they adhere to. (Mansour, 2008).Integration of science and religion and trying to bring religious beliefs closer to scientific theory (Khozin, 2016; Aflalo, 2018a new paradigm on the integration of science and Islam is important to be developed into a model.Science learning that connects with religion has a positive impact on students' learning outcomes. (Emzulia & Madlazim, 2014) Science learning that integrates religion can increase

motivation and understanding of concepts, providing meaningful learning experiences (Gamal & Mahalle, 2012; Taskin, 2014), and thinking skills (Sarwi et al, 2018).

Communication skills are thought to develop in prospective teachers through inquiry activities. In addition, the integration of science and religion is thought to increase communication activities in prospective teachers. Investigative learning activities, compiling reports, discussions and presentations train students to have good communication skills. To train students' communication skills, lecturers/teachers must provide discussions and oral presentations, investigation activities that involve report writing activities (Joseph, 2010; Noviyanti, 2011). Presenting science exhibitions, presenting science with local culture (Perera & Stocklmayer, 2013; Sarwi et al, 2019).

CONCLUSION

Based on the significance value, It is concluded that there is a difference between the control class and the experimental classbased onsignificance value < 0.05. The achievement of prospective science teachers is good. The aspects of understanding, planning, and solving problems are good. However, the evaluation thinking aspect is not optimal. The communication achievement skills of seven aspects, namely messages, message forms, channels, noise, context, impact, and ethics are good. Meanwhile, the competence aspect is not optimal. Based on research results. The recomendation of this research is that the lecture study can be applied in science teaching with another topic and integrated with verses from the Koran.

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AUTHOR CONTRIBUTIONS

Conceptualization, W, MNS, HD; Methodology, DPR, S; Writing Original Draft Preparation, DHK, ZM; Visualization, W.

CONFLICTS OF INTEREST

The author(s) declare no conflict of interest.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors declare that no artificial intelligence (AI) tools were used in the generation, analysis, or writing of this manuscript. All aspects of the research, including data collection, interpretation, and manuscript preparation, were carried out entirely by the authors without the assistance of AI-based technologies.

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