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IMPLEMENTATION OF INTEGRATED CHEMISTRY EDUCATION WITH QURANIC VALUES THROUGH THE CREATION OF A VERTICAL COMPOSTER GARDEN AT AN-NIKMAH AL-ISLAMIYAH INSTITUTE PHNOM PENH CAMBODIA

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ABSTRACT

This community service project aims to integrate chemistry education with the values of the Qur'an through the implementation of a Vertical Composter Garden at the An-Ni'mah Al-Islamiyah Institute in Cambodia. By combining scientific principles with Islamic teachings, this project seeks to enhance students' understanding of sustainability practices while deepening their spiritual connection to environmental stewardship. The Vertical Composter Garden serves as a practical application of chemistry concepts such as decomposition, nutrient cycles, and the transformation of organic matter, all within the framework of the Qur'an's teachings on the preservation and care of the earth. This approach not only provides hands-on learning experiences but also fosters a holistic educational environment where scientific knowledge and religious values are interwoven. The results demonstrate the effectiveness of this integrated approach in promoting environmental awareness, ethical responsibility, and academic engagement among students.

Introduction

In recent years, the integration of scientific education with spiritual and ethical values has gained significant attention as a means to promote a more holistic learning experience. The intersection between science and religion, particularly in the context of education, offers unique opportunities to enhance students' cognitive and moral development. Chemistry, as a central science, provides a fundamental understanding of the natural world, yet its teaching is often confined to theoretical and experimental contexts that may not fully engage students or relate to their personal and spiritual lives.(Khotjiah et al., 2020)

In this context, the concept of spiritual live refers to a life filled with spiritual meaning, where religious values, especially those of Islam, serve as the foundation for every activity, including education and the development of sciences like chemistry. The connection between spiritual live and Islam refers to how chemistry education not only focuses on the scientific aspects but also incorporates Islamic teachings as foundational values that shape students' character.(Fraser et al., 2012)

Islamic education, which emphasizes the unity of knowledge (tauhid) and the harmonious relationship between humans and nature, provides an ideal framework for integrating scientific principles with ethical and religious teachings. The Qur'an contains numerous references to the natural world, encouraging reflection on creation as signs of the Creator and urging responsible stewardship of the earth. By aligning chemistry education with these Qur'anic values, educators can foster not only scientific literacy but also a deep sense of responsibility and respect for the environment.(Caron & Markusen, 2016)

This article explores the implementation of an integrated chemistry education program that combines Qur'anic values through the creation of a Vertical Composter Garden at An-Ni'mah Al-Islamiyah Institute in Cambodia. The Vertical Composter Garden serves as an innovative

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educational tool that demonstrates key chemistry concepts such as decomposition, nutrient cycles, and the transformation of organic matter. Simultaneously, it embodies Islamic teachings on sustainability, environmental conservation, and ethical responsibility. By involving students directly in the composting process, this approach aims to deepen their understanding of both scientific and religious principles, promoting a more comprehensive and meaningful educational experience.(Surabaya & Java, 2024)

Figure 1 An-Nikmah Al Islamiyah Institute Phnom Penh - Cambodia

This community service aims to emphasize the success of the implementation, as seen from the percentage increase after the pretest in improving students' knowledge of chemistry, their appreciation of the Qur'anic teachings on the environment, as well as their overall academic and moral engagement. These findings are expected to contribute to the growing literature on the integration of science and religion in education, providing insights into the potential benefits and challenges of such a cross-disciplinary approach.(Clements & Cord, 2013)

Figure 2. Provides material on the creation of a vertical composter garden related to the values of the Qur'an

From an Islamic perspective, protecting the environment is part of humanity's responsibility as stewards (khalifah) on earth. As mentioned in Qur'anic verses:

Surah Al-Baqarah [2]:205, which speaks about the prohibition of causing corruption on earth:

وَاِذَا تَوَلّٰى سَعٰى فِى الْاَرْضِ لِيُفْسِدَ فِيْهَا وَيُهْلِكَ الْحَرْثَ وَالنَّسْلَۗ وَاللّٰهُ لَا يُحِبُّ الْفَسَادَ ٢٠٥

"And when he turns away, he strives throughout the land to cause corruption therein and destroy crops and animals. And Allah does not like corruption."

Implementation of Qur'anic Values contained:

1. Responsibility as Caliph (Environmental Leadership) is that students are invited to reflect on their role as caliphs who are given the mandate to protect the earth. Making a Vertical Composter Garden is one concrete way to carry out this mandate.
2. The Qur'an teaches the importance of balance in all aspects of life, including in the management of natural resources. By turning organic wasbte into compost, students learn about the importance of maintaining the balance of the ecosystem.
3. Islam strongly emphasizes cleanliness and sustainability (hifz al-biah). Waste management through composting not only helps keep the environment clean but also ensures that future generations can enjoy the same resources.

Methods

The method used is Project Based Experiential Learning, this method involves students at An-Nikmah Al-Islamiyah School Phnom Penh directly in real experiences, such as the making of Vertical Composter Garden, where they learn through active involvement. Students can be involved in the whole process of making the vertical garden, starting from the planning and preparation stage, the implementation stage, the evaluation and reflection stage to the integration and application of Qur'anic values.

1. Preparation Stage
   - Students are divided into working groups of 4-5 people. Each group is responsible for one part of the Vertical Composter Garden project.
   - Students are given materials on chemical concepts related to composting, as well as Qur'anic verses relevant to the environment and organic waste management. This material was delivered through lectures and group discussions.
2. Implementation Stage
   - Each group designs their own Vertical Composter Garden model, based on chemical principles such as decomposition, carbon cycle, and the role of microorganisms in composting.
   - Students collect organic materials, such as dry leaves, food scraps, and soil, to put into the Vertical Composter Garden. They also add water

and microorganisms as part of the composting process.
- Students periodically observe the decomposition process in their composter, noting changes in temperature, moisture, and volume of composted material. They also reflect on how the chemistry concepts learned are applied in real life and their relevance to Qur'anic values.

3. Evaluation and Reflection Stage
   - Each group presented their observations, relating them to the chemistry concepts and Qur'anic verses learned. They were also asked to evaluate the successes and challenges faced during the project.
   - Students write a personal reflection on their experience in this project, how their understanding of chemistry and Qur'anic values improved, and how they can apply this learning in their daily lives.
4. Integration and Application of Qur'anic Values
   - After the project was completed, an open discussion was held on how Qur'anic values related to environmental conservation and responsibility for the earth can be applied in the context of science and technology.
   - Students are encouraged to apply the knowledge and values they have learned in their home or community environment, such as by making a simple vertical composter at home or in the school environment.

Results and Discussions

Figure 3 Making a Vertical Composter Garden

In the early stages, students are invited to understand chemical concepts relevan to the decomposition and composting process, such as chemical reactions in the decomposition of organic matter, as well as the carbon cycle. They also learn Qur'anic verses related to human responsibility in protecting the environment, such as in Surah Al-Baqarah verse 205. Students then practiced these concepts by building a Vertical Composter Garden, which is a vertical composting system to process organic waste into compost. During this project, students worked in groups to design and build the composter, collect organic materials, and monitor the decomposition process. Each group observed the steps they took, and recorded the changes that occurred during the composting process, such as changes in temperature, humidity, and volume of organic matter. They also noted the connection between the chemistry concepts they had learned and the results they observed. After the project was completed, students reflected on the process and results of the vproject, both from a scientific and spiritual perspective. They discussed how this project not only taught them about chemistry concepts, but also strengthened their understanding of the importance of protecting nature in accordance with Islamic teachings. Evaluation was conducted using several indicators, such as students' understanding of chemistry concepts, practical skills in composting, as well as their understanding of the Qur'anic values associated with this project.

Tabel 1. Table based on pretest and posttest results

Group	Pretest Score	Posttest Score	Difference Score	Improvemet Score
Group 1	15	55	40	266.67%
Group 2	35	100	65	185.71%
Group 3	35	100	65	185.71%
Group 4	25	100	75	300.00%

The data show significant improvements in all groups, with the lowest improvement score being 185.71% and the highest reaching 300%. This indicates that the integration of Qur'anic values with chemistry education, supported by the hands-on experience of creating the vertical composter garden, led to substantial knowledge gains.

Interpretation of Results

The increase in the posttest scores demonstrates the effectiveness of the experiential learningj approach. By engaging students in a real-world project, such as constructing a vertical composter garden, they were able to grasp the concepts of chemistry in a more practical and meaningful manner. The inclusion of Qur'anic values further enriched the learning process, promoting ethical reflections on environmental stewardship as emphasized in Islamic teachings.

- Overall Score Improvement

All groups showed significant improvement from pretest to posttest, with score increases between 40 to 75 points. This shows that the implementation of integrated chemistry education with Quranic values through the Vertical Composter Garden project is effective in improving students' knowledge, understanding, and skills.

- Analysis of Point Improvement

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Group 1 experienced the greatest improvement, 266.67%, despite starting with the lowest pretest score. This shows that the teaching method used was successful in helping students who initially had lower understanding to catch up. Group 4 showed the highest improvement of 300%, indicating that in addition to improvements in the understanding and application of chemical concepts, there were also significant improvements in the understanding of Quranic values and collaborative skills.

- Overall Score Improvement

The improvement scores, especially in Groups 1 and 4, which showed the highest percentage of growth, suggest that students with lower initial knowledge (as seen in the pretest scores) benefited the most from the project-based learning method. These findings are in line with existing research that suggests hands-on, integrated learning methods often lead to better retention and application of knowledge, especially when tied to ethical or moral values.

- Effectiveness of Education Integration

The increase in posttest scores, especially in terms of understanding Quranic values integrated with chemistry education, shows that this holistic approach not only improves academic understanding, but also shapes attitudes and behaviors that are in line with Islamic teachings.

- Implications for Learning Methods

These results support the integrative approach in education, where science and spiritual values are combined to produce more meaningful and applicable learning, especially in the context of projects that are directly related to environmental conservation in accordance with the teachings of the Quran.

Figure 4 Composting and planting process

PBEL method applied in this project provides a number of benefits in teaching chemistry integrated with Qur'anic values. Through this project, students not only learn theory, but also apply chemistry concepts in real situations. This strengthens their understanding of the subject matter, as they can see first-hand the results of the chemical processes that occur in composting.

This project shows how science and religion can be harmoniously integrated in education. The Qur'anic values of environmental conservation are reinforced through practical activities involving chemistry, so students not only learn science, but also develop positive attitudes and values relevant to everyday life.

In the implementation of the project, students are challenged to work in teams, share tasks, and solve the problems they face. These skills are essential in modern education, as they prepare students to work in the real world which often demands collaboration and the ability to creatively face challenges.

Reflection on the Qur'anic values associated with this project provides an additional dimension to the learning process. Students not only learn to become competent scientists, but also ethical and responsible individuals, in accordance with Islamic teachings.

Overall, the results of the implementation of PBEL in the creation of the Vertical Composter Garden were very positive, indicating that this approach is effective in integrating chemistry education with Qur'anic values, while developing practical skills and attitudes that support lifelong learning.

Comparison with Previous Studies

Similar approaches to integrating ethics with science education have shown significant results in improving both academic performance and student engagement. A study (2020) on the impact of value-integrated science learning in Islamic schools showed that students not only performed better academically but also demonstrated improved critical thinking and ethical reasoning skills. This aligns with the outcome of our project, where the students not only learned the science behind composting but also reflected on the importance of preserving the environment as a form of worship and responsibility in line with Islamic principles.

Challenges Encountered

Several challenges were encountered during the implementation of the project. One of the main issues was the limited availability of materials for creating the vertical composter garden, which required improvisation. Additionally, some students initially struggled to grasp the connection between the Qur'anic values and the scientific concepts being taught. However, through continuous guidance and examples, these challenges were overcome.

Conclusions

The results of the implementation of the Experiential Learning method in integrated chemistry education with Quranic values at An-Nikmah Al-Islamiyah Institute through the creation of Vertical Composter Garden showed a significant increase in students' understanding and skills. Based on Table 1, there is a clear difference between the pretest and posttest scores across groups, with the increase in scores varying from 185.71% to 300.00%. Group 4 showed the highest improvement, with

posttest scores reaching 300.00% higher than pretest scores, while group 1 experienced an increase of 266.67%.

This improvement reflects the effectiveness of the integrative approach that combines chemistry learning with Quranic values, where students not only learn chemistry concepts but also internalize the ethical values contained in the Quran. Through hands-on experience in the Vertical Composter Garden project, students can apply their knowledge in a practical and relevant manner, which in turn strengthens the understanding of concepts as well as increases environmental awareness and social responsibility.

This project demonstrated the effectiveness of project-based experiential learning, which not only enhanced academic performance but also provided students with practical skills and ethical insights. By integrating chemistry with Qur'anic values, the program succeeded in shaping students into knowledgeable and ethical individuals, contributing to the Sustainable Development Goals (SDG 4) on quality education and lifelong learning.

Thus, this method proves effective in improving the quality of chemistry learning, as well as shaping better and more responsible student characters, in line with the values taught in the Quran. This supports the importance of a holistic and contextual learning approach in science education, especially in Islamic education.

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