Integration of the Values of Surah Al Maun with the STEM Approach as a Learning Model for Muhammadiyah Schools

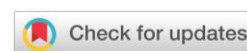**Rofiq Nurhadi[1], Siska Desy Fatmaryanti[1*] Hüseyin Emin Sert[2], Jarot Wahyudi[3]**

[1]Universitas Muhamamadiyah Purworejo, Indonesia

[2]Istanbul Medeniyet Universitesi, Turkiye

[3]Universitas Islam Negeri Sunan Kalijaga Yogyakarta, Indonesia

email: siskadesy@umpwr.ac.id

Check for updates

ABSTRACT

Article Info:
Submitted:
23/10/2023
Revised:
29/11/2023
Published:
29/12/2023

Developing learning models that are in line with technological advances can build student values and character through the integration of Al-Quran values. One of the surahs in the Al-Quran is surah Al Ma'un, which is strong in instilling social attitudes or concern for the social environment and is the main basis for the Muhammadiyah movement. This research aims to produce a science learning model using a STEM approach containing Al Ma'un and determine the effectiveness of the STEM approach with Al Ma'un as a learning model in improving students' scientific attitudes and social awareness in Muhammadiyah schools. This research is a development research using the Plomp model. The research is conducted at 3 Muhammadiyah Middle Schools in Purworejo Regency. The feasibility of the learning model is carried out by expert validation in terms of syntax, social system, reaction principle, support system, and instructional impact. To test the effectiveness, it uses data on the percentage of pre- and post-observation results. The research results show that the learning model using the STEM approach containing Al Ma'un is valid and suitable for use. The effectiveness of the learning model is also high, based on the percentage increase in students' social awareness and scientific attitudes. This learning model can become an excellent learning model for Muhammadiyah schools. Apart from that, it can also be applied to Islamic schools in general for character development in aspects of social attitudes and social environment.

Keywords: *Al Ma'un; STEM; Learning Model; Social Awareness; Scientific Attitude*

ABSTRAK

Mengembangkan model pembelajaran yang sejalan dengan kemajuan teknologi dapat membangun nilai dan karakter siswa melalui integrasi nilai-nilai Al-Qur'an. Salah satu surah dalam Al-Qur'an adalah surah Al Ma'un yang kuat dalam menanamkan sikap sosial atau kepedulian terhadap lingkungan sosial dan menjadi landasan utama gerakan Muhammadiyah. Penelitian ini bertujuan untuk menghasilkan model pembelajaran IPA dengan pendekatan STEM bermuatan Al Ma'un dan mengetahui keefektifan pendekatan STEM dengan model pembelajaran Al Ma'un dalam meningkatkan sikap ilmiah dan kesadaran sosial siswa di sekolah Muhammadiyah. Penelitian ini merupakan penelitian pengembangan

dengan menggunakan model Plomp. Penelitian dilakukan di 3 SMP Muhammadiyah di Kabupaten Purworejo. Kelayakan model pembelajaran dilakukan melalui validasi ahli ditinjau dari sintaksis, sistem sosial, prinsip reaksi, sistem pendukung, dan dampak pembelajaran. Untuk menguji efektivitas menggunakan data persentase hasil observasi sebelum dan sesudah. Hasil penelitian menunjukkan bahwa model pembelajaran dengan pendekatan STEM bermuatan Al Ma'un valid dan layak digunakan. Efektivitas model pembelajaran juga tinggi berdasarkan persentase peningkatan kesadaran sosial dan sikap ilmiah siswa. Model pembelajaran ini dapat menjadi model pembelajaran unggulan bagi sekolah muhammadiyah. Selain itu juga dapat diterapkan pada pesantren pada umumnya untuk pengembangan karakter dalam aspek sikap sosial dan lingkungan sosial.

Kata-kata Kunci: Al Ma'un; STEM; Model Pembelajaran; Kesadaran Sosial; Sikap Ilmiah

1. INTRODUCTION

Education can provide knowledge and skills to society as well as shape the personality of a nation's young generation (Idris et al., 2012). In Indonesia, as regulated in the National Education System Law, national education functions to develop skills and form a dignified national character and civilization in order to make the nation's life more intelligent. The aim of national education is to develop students' abilities to become human beings with noble character, knowledge, creativity, independence, as well as supportive and responsible citizens. To make this happen, efforts need to be made to improve education through innovative learning that is in line with current developments and technology. Apart from being in line with technological advances, education is also expected to be able to shape the values and character of students through instilling religious values (Hayati et al., 2020; Idris et al., 2012).

To carry out the mandate of this law, the government, schools and society must maintain the quality of education so that education can run better. In line with this, as many as 1,111 junior high schools and 1,291 senior high schools under the Muhammadiyah association which are part of the National Education System continue to strive to maintain and improve the quality of education, especially in the learning process. This is certainly in line with Muhammadiyah's hope that from Muhammadiyah educational institutions humans who can fulfill their function as servants and caliphs of Allah on earth will be born (Ali, 2014). It is hoped that Muhammadiyah education can give birth to believers who are able to embody the values of monotheism in everyday life.

Minister of Education and Culture Regulation Number 22 of 2016 concerning Education Process Standards has not yet explain technically the learning process that is able to lead students to achieve spiritual attitude competence. More technical development by teachers is needed through the learning process. Social values and the surrounding environment have an important role in developing learning. However, the implementation of learning in schools still often revolves around textbooks and lectures in class. There are

many approaches that can be applied in classroom teaching, including the Science, Technology, Engineering and Mathematics (STEM) approach.STEM-based learning approach that is associated with the environment will present real world (real life) for students in everyday life (Juškevičienė et al., 2021; Watkins &Mazur, 2016). STEM-based science learning is learning the subject matter of science that includes integrating the use of technology for solving real problems (Firman, 2015).In recent years, the development of research on the application of STEM in learning has been quite significant.Learning with a STEM approach focuses on how to guide students in developing their abilities in integrating interdisciplinary knowledge (Johnson & Czerniak, 2023; Juškevičienė et al., 2021).In its application, it requires challenging assignments or questions from teachers that can stimulate students to use STEM to find solutions (Lesseig et al., 2016).

As the Holy Book of Islam, the Qur'an has provided inspiration for the development of science.A systematic process, analysis and exploration of an object has been indicated in the Quran (Mufid, 2014). Research on the integration of Al Quran in the learning has been done (Fahyuni et al., 2020; Surajudeen & Mat, 2013). The integration of Al-Qur'an values in learning has contributed to the development of learning to achieve educational goals. However, specific research regarding embedding the value of Surah Al-Ma'un in STEM-based learning has never been carried out.

Al-Ma'un is the name of one of the 114 *surah*s in the Al-Qur'an.It is the 107th surah. This surah is a *Makkiyah* surah.In the language Al-Ma'un means "useful things".One of the values contained in this surah is social value (Shihab, 2006). Among the social values that need to be developed in learning is social concern.Students' social awareness after participating in STEM-based learning is expected to grow and develop.This is in line with the nature and character of the Muhammadiyah movement.The Muhammadiyah movement was built at the beginning of the 20th century on the foundation and theological strength of Surah al-Maun taught by KH.Ahmad Dahlan.The founder of Muhammadiyah taught that ritual worship is meaningless if it does not result in social kindness.This letter even calls those who ignore orphans and do not try to relieve society of poverty as 'religious liars' (Majelis Diktilitban & LPI PP Muhammadiyah, 2010).

Based on Al-Ma'un theology, the Muhammadiyah Movement built three pillars of work, namely: healing (health services), schools (education), and feeding (social services).This theology is claimed to be able to make the Muhammadiyah organization survive for more than 100 years by having thousands of schools, hospitals, orphanages and other social welfare services.Ahmad Dahlan also interpreted Al-Ma'un into three main activities, namely education, health and aidsfor the poor.The founder of Muhammadiyah has transformed the understanding of religion from just sacred doctrine (Gunawan, 2018). According to Ahmad Dahlan, learning requires theory and practice at

the same time. If theory has not been put into practice then it is certain that there will be no further theoretical learning.On this basis, Al-Ma'un theology became part of Muhammadiyah's ideology which operates in the social and humanitarian fields (Majelis Diktilitban & LPI PP Muhammadiyah, 2010).

In line with Al-Ma'un values, education also has a high correlation with social awareness.Research conducted in the field of education illustrates that education and employment are important instruments for modernization and social awareness of a society (Wani & Nadeem, 2016). Social awareness refers to factual knowledge about important aspects of social systems and related issues. It also refers to an individual's capacity to make a correct diagnosis and develop a scientific attitude.

Scientific attitudes are attitudes possessed by scientists in seeking and developing new knowledge, such as objective, careful, responsible, open-minded, always want to research, and others (Potvin & Hasni, 2014; Waddington, 2016). The scientific attitude referred to in this study relates to students' attitudes in responding and discovering new knowledge through several scientific methods or processes. The attitude should be developed to be owned by junior high school students.

The problem examined in this study is how to produce a science learning model using a STEM approach containing Al Ma'un and determine the effectiveness of the STEM approach with Al Ma'un as a learning model in improving students' scientific attitudes and social awareness in Muhammadiyah junior high school.

2. METHOD

This research uses the Plomp model which is included in the type of development research.The learning model was developed through 4 stages, namely the (1) preliminary study stage, (2) the design stage, (3) the realization stage, and (4) the evaluation and revision stage (Plomp, 2013). Preliminary research regarding learning conditions related to the science learning syllabus, Surah Al Maun values that are appropriate to learning was carried out at the preliminary study stage.In this stage, research data was obtained from literature studies, interviews and observations which were processed descriptively quantitatively. At the design stage, the process of designing the syntax of the learning model and instruments for assessing students' social awareness and scientific attitudes is carried out. The realization/construction stage contains model validation based on syntax, social system, reaction principle, support system, and instructional impact.Meanwhile, the evaluation and revision stage contains activities for testing learning models in schools.

The research was conducted at 3 Muhammadiyah Middle Schools in Purworejo Regency by implementing the learning model in science subject. The sample for the field trial stage for each school was taken from the 1st grade consisting of 20-25 students selected using a purposive sampling technique.The trial design used a pre-experimental design with a pre-observation and post-observation.

The data collection technique was carried out through: (1) literature study and observation as preliminary study data for the development of a STEM learning model that is integrated with Al Maun values, (2) questionnaire for data on the validity of the learning model, and (3) Observation for data on the effectiveness of implementing the learning model.

Validity test analysis used concept and content validity analysis of the learning model. The product in the form of a learning model was assessed for its suitability by expert judgment consisting of 2 lecturers who are experts in model development and 1 lecturer who is an expert on Islamic and Muhammadiyah material. The results of the product assessment, the average score for each aspect of the assessment, are then converted into a value. A product is said to be worthy if it gets a minimum score of C in the quite worthy category. The reference for converting scores into a value scale is presented in table 1 with ideal average ($\bar{X}_l$), standar deviation (SB_i) and ideal score (X). To test the effectiveness of the implementation of learning model, we use data from pre-post observations results to measure with percentage data analysis.

Table 1. Convertion of the actual score into grades on a scale of 5

Score Interval	Grade	Category
$X > \bar{X}_l + 1.8SB_i$	A	Very good
$\bar{X}_l + 0.6SB_i < X \le \bar{X}_l + 1.8SB_i$	B	Good
$\bar{X}_l - 0.6SB_i < X \le \bar{X}_l + 0.6SB_i$	C	Sufficient
$\bar{X}_l - 1.8SB_i < X \le \bar{X}_l - 0.6SB_i$	D	Less
$X < \bar{X}_l - 1.8SB_i$	E	Very less

3. RESULTS AND DISCUSSION

The results of research on the development of this learning model are presented in detail at each stage as follows.

a. Preliminary study stage

Despite the fact that this study is conducted in a school withreligious background, religious values are not infused into the learning process in topics other than religious studies. Based on the analysis of teachers, consider developing a learning model using a STEM approachIt is discovered that teachers showed a desire to develop the model but lack of the insight/knowledge and skills to do so. In Islam, religion and science are inseparable. However, the establishment of the scientific dichotomy resulted in a tendency to dominate the non-religious sciences. As a result, non-religious sciences have few opportunities to develop in many Islamic educational systems (Hidayat, 2015).

Based on the results of interviews and observations at 3 Muhammadiyah schools in Purworejo, so far, science learning has focused on helping students understand the content of science material. In fact, in order for science learning to be more meaningful,

real experience from students' daily lives is needed (Dagar & Yadav, 2016). From the curriculum analysis of science material carried out by researchers and teachers, this research will be applied to environmental pollution material.The basic competencies of this material is that students are able to analyze the occurrence of environmental pollution and its impact on the ecosystem and write about ideas for solving pollution problems in the environment based on the results of observations (Rachmawati, 2018).

Texts of The holy book (*qauliyyah* verses) as a source of knowledge in its application and implementation must also have a moral responsibility towards humanistic values in the context of the axiological dimension (Janah & Nugroho, 2022).The results of the analysis of Surah Al Maun from several studies found that doing good things in *mu'amalah* or socializing in Community life can be interpreted as caring for the environment and being sensitive to social problems (Bariyah et al., 2022; Gunawan, 2018). The basic competency of science subjects in environmental pollution material can be integrated with the values from Surah Al Maun as in the Table 2.

Table 2. Basic Competencies in Learning Science with integrated Al Ma'un Values

Basic competencies	The values of surah Al Ma'un in learning science
Carry out an analysis of environmental pollution and the impact of pollution on the ecosystem	Humans as social creatures should have concern for the surrounding environment.
Create a project about solving environmental pollution problems based on observations that have been made	Help provide solutions to the problems by using knowledge that has been owned

In line with that, the integration of Al-Qur'an and Hadith studies on biology learning has found the percentages of the integration based on topic in biology (Mualimin & Subali, 2018) and through Pedagogical Content Islamic Knowledge (PCIK) can increase knowledge and competence in integrating Islamic values and Biology (Herlanti et al., 2022). As an important part of people's lives, the interpretation of the Koran in its development cannot be separated from technology. Other research also provides evidence that the presence of technology supports the presence of religion in millennials and not vice versa (Putra & Hidayaturrahman, 2020).

b. Design Stage

Stages of new learning model can be determined by literature studies and focus group discussion with teacher and learning expert (Fatmaryanti et al., 2018; Zain et al., 2016). Based on the need analyses, we have made the stages of learning science with STEM approach that is integrated with the *surah* Al Ma'un. There are 5 main stages in this study, including social and environmental observation, reflection, innovation,

application, and social and environmental values. The purpose in each stage can be shown in figure 1.
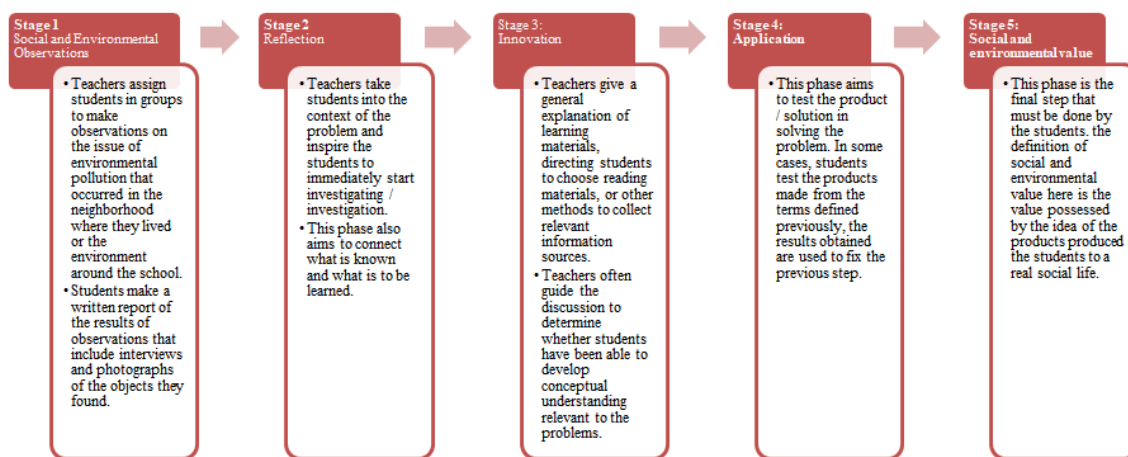

Figure 1. The purpose of Stages in learning science with STEM approach with Al Ma'un

Figure 1 shows that the role of teacher in this learning model is more as a guide and motivator. The role and function of the Islamic school principals are not only as a leader, but they have other roles and functions of an educator (Nusantara et al., 2022), a manager (Hartati et al., 2019), an administrator, a supervisor, a leader, an innovator, and a motivator (Machali, 2018). This learning model has been applied to science subjects with the topic of environmental pollution. In stage 1, students report the results of observations obtained through interviews and photography regarding the social and environmental conditions around them. This process is an activity to train students' social awareness through learning about the surrounding environment. Contextual learning that is close to their daily lives can become a basis for students' understanding so that it can be directly applied in their social life (Luthfiyah et al., 2022).

In stages 2 and 3, the teacher bridges students to connect the knowledge they have already had with the material to be studied, then to be discuss solutions to existing environmental pollution problems. In accordance with cognitive theory, learning is a change in mental (cognitive) structure where learning is a combination of prior knowledge and what is currently being learned to build new knowledge (Fatmaryanti et al., 2018; Kuhn & Dean, 2008). Stage 4 and 5 can be said to be the stage of reconstructing students' thinking in the form of a technology project to solve pollution problems. In accordance with the objectives of the STEM approach in learning, it is hoped that it can produce meaningful learning for students through the systematic integration of knowledge, concepts and skills (Minarti et al., 2022; Watkins & Mazur, 2016).The resulting technology is an application of science. Even though it is still simple technology, it can make students solve problems better and provide solutions to environmental problems.

c. The realization stage

Based on the results of a literature search regarding the types of learning methods that can be used in science learning with a STEM approach containing Al Ma'un are observation methods, experiment-based projects, and group discussions. Meanwhile, the assessment system that can be used is a non-test assessment carried out during the learning process. The results of the validation of the learning model developed consist of elements of syntax, social system, reaction principle, support system and instructional impact and accompaniment presented in Table 3.

Table 3. Validation results of the Al Maun integration learning model with a STEM approach

Aspect	Average Score	Maximum Score	Grade
Syntax	8.5	9	A
Social system	9.6	10	A
Reaction principle	7.8	8	A
Support system	7.3	9	B
Instructional impact	8.0	10	B

In this research, we use 7 aspects for assessment of scientific attitudes which include curiosity, respect for data / fact, critical thinking, discovery and creativity attitude, open minded attitude, persistence, and environmental sensitivity (Blalock et al., 2008). For indicators of social awareness in the school environment, we use 4 indicators including (1) show responsive behavior to friends and school residents who are experiencing difficulties; (2) Shows the behavior of mutual cooperation among friends; (3) show empathy behavior towards friends; and (4) implement social action (Hamid et al., 2017).

The validation results show that this learning model has easy learning steps to implement operationally from the syntax aspect. From the social system aspect, there is a clear pattern of relationships between students and teachers. In general, this learning model has compatibility between the roles of teachers and students with a constructivist approach and meaningful learning theory viewed from the aspect of the reaction principle (Lesseig et al., 2016). The learning model also has a support system in the form of learning plans and student worksheets that are in accordance with the model relevant to the assessment instruments used. The final point of the validation results is that the coverage of the types of instructional and accompanying impacts is relevant to the model being developed. The development of science knowledge, science process skills and scientific attitudes in individuals exposed to science courses are the major goals of Science Education (Ataha & Ogumogu, 2013). However, the assessment of scientific attitude (affective domain) is not as simple as comparing to that of the scientific knowledge (cognitive domain) and science process skills (psychomotor domain) and this

scientific attitude is one of the important aspects of today's science throughout the globe (Mukhopadhyay, 2014).

d. Evaluation and revision stage

The main objective of learning implementing a STEM approach based on Al Ma'un is to enhance the students' scientific attitude and awareness. As a result, in each meeting, the scientific attitude and social caring attitude are constantly observed. One class has two meetings, which means one class has two observations. The findings of this observation are used to assess learners' scientific attitudes and care attitudes. Another study discovers that the relationship between science and religion is axiological, which means that the entire value between the two is mutually qualified (Mufid, 2014). It means that while sciences are justified by religious value, sciences must be illuminated by religious worth. The implications of scientific progress are always aligned with moral and religious values.
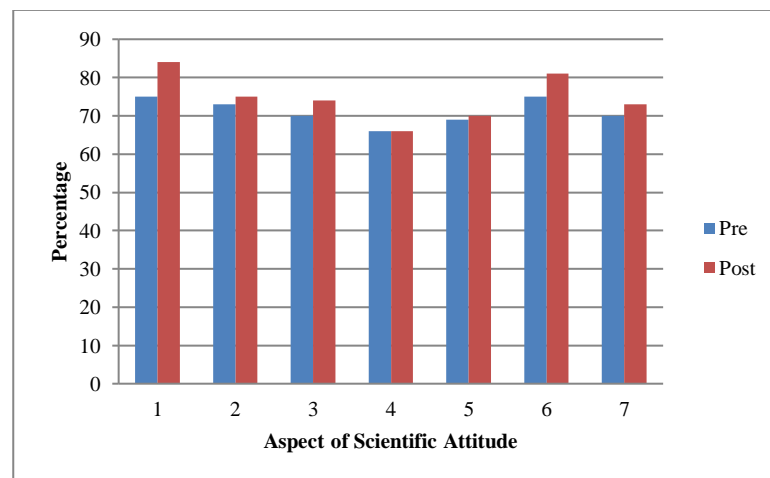

Figure 2. Percentage of initial and final observation score of scientific attitudes

Based on figure 2 we can see that the percentage of each aspect of scientific attitude on preliminary observation and final observation of STEM learning. There was an increase in respect for data / facts, critical thinking, openness and cooperation, and attitudes sensitive to the surrounding environment. This shows that in learning with STEM model based on Al Ma'un is effective to improve students' scientific attitude. Another research also finds that scientific attitude is not significantly influenced by sex (Ataha & Ogumogu, 2013; Tannenbaum et al., 2019). They recommend among others that continuous experimentation and laboratory activities are urgently needed; hence, the dichotomy between theory and experimentation should be stopped in the texting of science in secondary schools. In other research it has been found that critical thinking from the Al-Quran perspective and rationalizing the relationship between critical thinking from the Al-Quran and western perspectives are necessary in preparing students with 21st century skills (Minarti et al., 2022; Ramli et al., 2018).

Indicators of social awareness attitude consist of 4 aspects, which are: show responsive behavior toward friends and school residents who are experiencing difficulties, show the behavior of mutual cooperation among friends, show empathy behavior toward friends, and show harmonious behavior to school citizen. The observation result of social awareness attitude is presented in figure 3.
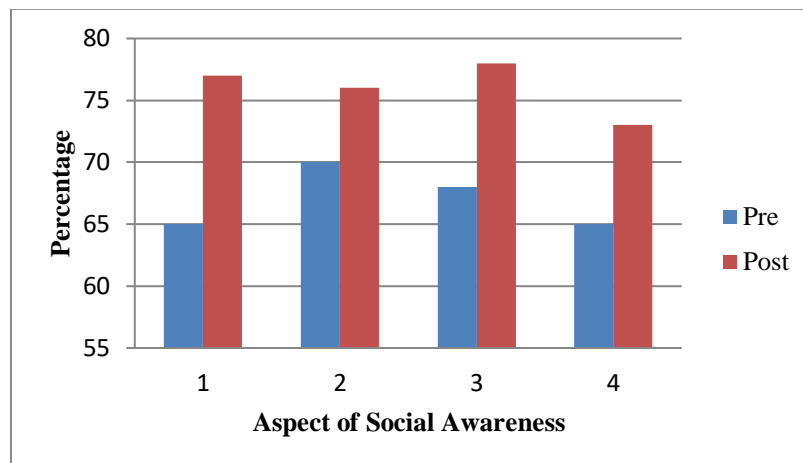

Figure 3. Graphic of social awareness percentage from pre- and post-observation

Based on figure 3 we can know the percentage of each indicator of social awareness attitude on preliminary observation and final observation of STEM learning. Figure 3 showed that the percentage of all aspect has increased. This shows that in learning with the value of Al Ma'un based STEM approach is effective to improve the attitude of social awareness of learners. This finding is in line with the Islamic view that is transformative. That Islam does not merely contain a set of religious rituals and "*hablun min Allah*" (relationship with Allah), but rather cares and is involved in solving concrete problems faced by humans (Gunawan, 2018). The values that must be developed in students are: awakening of students' thoughts, words, and actions which are carried out based on divine or derived values from the teachings of the religion they adheres to (Hayati et al., 2020). For this reason, students are expected to truly understand and practice what has been taught in everyday life. Religious teachings not only teach to have a good relationship with God but also with other people.

All three strategies utilized in this model are appropriate for use in learning science in order to increase students' thinking skills (Kuhn & Dean, 2008). The outcomes of the non-test evaluation are also compatible with the findings of Suastra (2006), who claims that authentic assessment is very beneficial in learning science. During this test, the sole successful method of assessing student learning is considered. However, the results of this study's questionnaire show that the non-test assessment scored higher on average than the test. This indicates a shift in the prominence of non-test assessment in learning science.

From the evaluation of implementation, assistance from teachers is needed in several ways. First, providing opportunities for students to identify pollution problems in their environment. The aim is to train students' sense of social and environmental awareness. Second, providing students with examples of environmental problems that exist in wider society and the use of science in solving the problems. Third, encouraging students to actively ask questions, comment and solve problems. Fourth, motivating students to participate in solving the problems that exist in the neighborhood with the knowledge that has been owned, so the social concept of Al Ma'un can be embedded in self-learners.

4. CONCLUSION

Based on the research and formulation of the problem, we found a model approach to science learning with STEM that contains Al Ma'un includes five phases (Observation of Social and neighborhood, reflection, innovation, application and social and neighborhood value). This learning model is suitable to be used as model in learning science at school. Eligibility product viewed from the aspects of syntax, social system, reaction principles, support systems and impacts Instructional included very good category based on validation results. The level of effectiveness of the learning model is high, based on teacher and student activity as well as the percentage of increased social awareness and scientific attitude.The results of this research not only offers enhancing discussion on new learning model for Muhammadiyah Schools, but it also expects a future research in developing student's character in aspects of social attitudes and social environment with more diverse forms of science, technology, environmental and mathematical activities. Therefore, it can also be applied to Islamic schools in general.

5. ACKNOWLEGDMENT

6. REFERENCES

Ali, M. (2014). Membedah Tujuan Pendidikan Muhammadiyah. *Profetika Jurnal Studi Islam*, *17*(1), 43–56. http://journals.ums.ac.id/index.php/profetika/article/viewFile/2099/1489

Ataha, U. C., & Ogumogu, A. E. (2013). An Investigation Of The Scientific Attitude Among Science Students In Senior Secondary Schools In Edo South Senatorial. *Journal of Education and Practice*, *4*(11), 12–17.

Bariyah, N. O., Candra, S., Rohmah, S., & Fadil, A. (2022). Spirit Al Ma ' Un Dalam Kurikulum Al Islam dan Kemuhammadiyahan. *Seminar Nasional Penelitian LPPM*

UMJ, *E-ISSN:2745-6080*, 2–11. https://jurnal.umj.ac.id/index.php/semnaslit/article/view/14287

Blalock, C. L., Lichtenstein, M. J., Owen, S., Pruski, L., Marshall, C., & Toepperwein, M. A. (2008). In pursuit of validity: A comprehensive review of science attitude instruments 1935-2005. *International Journal of Science Education*, *30*(7), 961–977. https://doi.org/10.1080/09500690701344578

Dagar, V., & Yadav, A. (2016). Constructivism: A Paradigm for Teaching and Learning. *Arts and Social Sciences Journal*, *7*(4), 66–70. https://doi.org/10.4172/2151-6200.1000200

Fahyuni, E. F., Wasis, Bandono, A., & Arifin, M. B. U. B. (2020). Integrating islamic values and science for millennial students' learning on using seamless mobile media. *Jurnal Pendidikan IPA Indonesia*, *9*(2), 231–240. https://doi.org/10.15294/jpii.v9i2.23209

Fatmaryanti, S. D., Suparmi, Sarwanto, Ashadi, & Kurniawan, H. (2018). Magnetic force learning with Guided Inquiry and Multiple Representations Model (GIMuR) to enhance students' mathematics modeling ability. *Asia-Pacific Forum on Science Learning and Teaching*, *19*(1), 1–22.

Firman, H. (2015). Pendidikan Sains Berbasis STEM: Konsep, Pengembangan, Dan Peranan Riset Pascasarjana. *Seminar Nasional Pendidikan IPA Dan PKLH*.

Gunawan, A. (2018). Teologi Surat Al-Maun Dan Praksis Sosial Dalam Kehidupan Warga Muhammadiyah. *SALAM: Jurnal Sosial Dan Budaya Syar-I*, *5*(2), 161–178. https://doi.org/10.15408/sjsbs.v5i2.9414

Hamid, S., Ijab, M. T., Sulaiman, H., Anwar, R., & Norman, A. A. (2017). Social Media for Environmental Sustainability Awareness in Higher Education. *International Journal of Sustainability in Higher Education*, *18*(4), 48–62. https://doi.org/https://doi.org/10.1108/1467630110380299

Hartati, S., Pepriyeni, P., & Suryana, A. (2019). Managerial skills of principal in private secondary school categorized islamic characteristic. *2nd International Conference on Research of Educational Administration and Management (ICREAM 2018)*, 139–144.

Hayati, F. N., Suyatno, S., & Susatya, E. (2020). Strengthening of Religious Character Education Based on School Culture in the Indonesian Secondary School. *The European Educational Researcher*, *3*(3), 87–100. https://doi.org/10.31757/euer.331

Herlanti, Y., Noor, M. F., & Zein, N. (2022). The Integration Of Islamic Values And Biology Education Using Pedagogical Content Islamic Knowledge (PCIK). *Jurnal Tarbiyatuna*, *13*(1), 43–62. https://doi.org/10.31603/tarbiyatuna.v13i1.6103

Hidayat, F. (2015). Pengembangan Paradigma Integrasi Ilmu : Harmonisasi Islam dan Sains dalam Pendidikan. *Jurnal Pendidikan Islam*, *IV*.

Idris, F., Hassan, Z., Ya'acob, A., Gill, S. K., & Awal, N. A. M. (2012). The Role of Education in Shaping Youth's National Identity. *Procedia - Social and Behavioral Sciences*, *59*, 443–450. https://doi.org/10.1016/j.sbspro.2012.09.299

Janah, N., & Nugroho, I. (2022). Fazlur Rahman's Thoughts of Double Movement in the Contextof the Development of Unity of Sciences. *Jurnal Tarbiyatuna*, *13*(1), 63–81. https://doi.org/10.31603/tarbiyatuna.v13i1.5718

Johnson, C. C., & Czerniak, C. M. (2023). Interdisciplinary approaches and integrated STEM in science teaching. In *Handbook of research on science education* (pp. 559–585). Routledge.

Juškevičienė, A., Dagienė, V., & Dolgopolovas, V. (2021). Integrated activities in STEM environment: Methodology and implementation practice. *Computer Applications in Engineering Education*, *29*(1), 209–228. https://doi.org/https://doi.org/10.1002/cae.22324

Kuhn, D., & Dean, D. (2008). Scaffolded Development of Inquiry Skills in Academically Disadvantaged Middle-School Students. *Journal of Psychology of Science and Technology*, *1*(2), 36–50. https://doi.org/10.1891/1939-7054.1.2.36

Lesseig, K., Nelson, T. H., Slavit, D., & Seidel, R. A. (2016). Supporting Middle School Teachers' Implementation of STEM Design Challenges. *School Science and Mathematics*, *116*(4), 177–188. https://doi.org/https://doi.org/10.1111/ssm.12172

Luthfiyah, L., Suciani, S., & Ruslan, R. (2022). Social Sensitivity Improvement through Collaborative Learning Models in Islamic Religious Education. *Jurnal Tarbiyatuna*, *13*(1), 29–42. https://doi.org/10.31603/tarbiyatuna.v13i1.5809

Machali, I. (2018). Managing Quality of Learning in Islamic Schools : An Analysis of Contributing Factors for Learning Toward Quality Improvement in Private Islamic Senior High Schools in Yogyakarta. *Jurnal Pendidikan Islam*, *7*(December).

Majelis Diktilitban & LPI PP Muhammadiyah. (2010). *1 abad Muhammadiyah : gagasan pembaruan sosial keagamaan.* Kompas.

Minarti, I. B., Dzakiy, M. A., & Nilautama, D. (2022). The Effect of STEM (Science, Technology, Engineering, and Mathematics) Based Learning Approach on Critical Thinking Skills and Cognitive Learning Outcomes of Class X SMA Negeri 1. *At-Tasyrih: Jurnal Pendidikan Dan Hukum Islam*, *8*(2), 126–136.

Mualimin, & Subali, B. (2018). The Integration of Al-Qur'an and Hadith Studies on Biology Learning at Islamic Senior High Schools in Magelang Indonesia. *Journal of Physics: Conference Series*, *1097*(1). https://doi.org/10.1088/1742-6596/1097/1/012045

Mufid, F. (2014). Islamic Sciences Integration. *Qudus International Journal of Islamic Studies*, *2*(2), 144–160. https://doi.org/10.21043/QIJIS.V2I2.1565

Mukhopadhyay, R. (2014). Scientific attitude – some psychometric considerations. *IOSR Journal Of Humanities And Social Science (IOSR-JHSS)*, *19*(1), 98–100. www.iosrjournals.org

Nusantara, W., Roesminingsih, M., & Widyaswari, M. (2022). Analysis of Principal's Leadership at Unesa Lab School. *Tarbawi: Jurnal Keilmuan Manajemen Pendidikan*, *8*(01), 37–48. https://doi.org/10.32678/tarbawi.v8i01.5692

Plomp, T. (2013). Educational design research: An introduction. *Educational Design Research*, 11–50.

Potvin, P., & Hasni, A. (2014). Interest, motivation and attitude towards science and technology at K-12 levels: a systematic review of 12 years of educational research. *Studies in Science Education*, *50*(1), 85–129. https://doi.org/10.1080/03057267.2014.881626

Putra, D. I. A., & Hidayaturrahman, M. (2020). The roles of technology in al-Quran

exegesis in Indonesia. *Technology in Society*, *63*, 101418. https://doi.org/https://doi.org/10.1016/j.techsoc.2020.101418

Rachmawati, R. (2018). Analisis Keterkaitan Standar Kompetensi Lulusan (SKL), Kompetensi Inti (KI), Dan Kompetensi Dasar (KD) Dalam Implementasi Kurikulum 2013. *Tatar Pasundan: Jurnal Diklat Keagamaan*, *12*(34), 231–239. https://doi.org/10.38075/tp.v12i34.73

Ramli, A. A., Ibrahim, N. H., Yusof, F. M., & Surif, J. (2018). Critical Thinking from STEM Education and Al Quran Perspective. *Journal of Engineering Science and Technology*, *Special is*, 35–41.

Shihab, M. Q. (2006). *Tafsir Al-Misbah Pesan, Kesan dan Keserasian al-Qur'an* (15 cetakan). Lentera Hati.

Surajudeen, A. T., & Mat, M. Z. A. (2013). Classification and Integration of Knowledge : The Qur ' ānic Educational Model. *Revelation and Sciene*, *03*(02), 9–22.

Tannenbaum, C., Ellis, R. P., Eyssel, F., Zou, J., & Schiebinger, L. (2019). Sex and gender analysis improves science and engineering. *Nature*, *575*(7781), 137–146. https://doi.org/10.1038/s41586-019-1657-6

Waddington, C. H. (2016). *The Scientific Attitude*. Routledge.

Wani, T. A., & Nadeem, N. A. (2016). Social Awareness Among Higher Education Teachers. *International Journal of Scientific Research and Education*, *4*(2), 4914–4919. https://doi.org/10.18535/ijsre/v4i02.7

Watkins, B. J., & Mazur, E. (2016). Retaining Students in Science , Technology , Engineering , and Mathematics (STEM) Majors. *Journal of College Science Teaching*, *42*(5), 36–41.

Zain, S., Ahmad, Z., & Ismail, A. F. (2016). Development of integrated curriculum and teaching materials for science/engineering courses. *Journal of Education and Social Sciences*, *4*, 18–25.