Journal of Positive School Psychology
2022, Vol. 6, No. 3, 4898 – 4920 http://journalppw.com

# Application Of Fuzzy Delphi Method In Designing A Basic Teaching Model Based On Moral Values In Stem Mathematical

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**Abstract**

Exam-oriented teaching makes students feel that mathematics is tedious and difficult. STEM knowledge among teachers is also quite limited due to a lack of exposure and training. Social problems moral decay among teenagers and school children are worrying. This will have a significant impact on unity, harmony, and the education system in the future. However, it is hoped that the basic model of teaching based on moral values in STEM Mathematics subjects can overcome this problem. This is also in line with the aspirations of the National Education Philosophy, Teacher Education Philosophy, SBELC Mathematics Goals for primary schools. This study focuses on designing a basic model of teaching based on moral values using FDM to produce a balanced human capital referring to a combination of Islamic and western models, namely the model of Al-Ghazali, Ibn Miskawaih, and Model 5E. The objective of this study was to obtain experts' consensus in determining validation of the moral values elements in the basic model of Mathematics and STEM teaching at the primary school level. This study is quantitative using the survey method. A questionnaire was given to 29 experts in Mathematics education, moral values, STEM, model development and education. After the validation process, all data were collected and analysed using the Fuzzy Delphi Method. The results of the study showed that based on experts' consensus, out of 50 elements, 38 elements of moral values were accepted, and 12 elements were rejected when the three main conditions were met, namely the threshold value d is equal to or less than 0.2, the percentage of expert agreement is the same or more than 75%, and the Defuzzification value (alpha cut) α is equal to or greater than 0.5. These findings indicated that 32 value-moral elements are indispensable in the basic teaching model in primary schools in STEM Mathematics subject based on experts' consensus. The study of the design of this model is expected to produce students who excel academically, especially in the matter of Mathematics, have STEM skills, and have good morals, personality, character holistically. Teachers should teach Mathematics based on moral values to practice moral values, be more active in learning, love Mathematics, have a mathematical mind, see the beauty of mathematics, and apply mathematical knowledge and skills and moral values in daily life.

**Keywords:** moral values, Fuzzy Delphi Method, basic teaching model, Mathematics, STEM

## INTRODUCTION

Quality education is the intention of the Ministry of Education to produce students who excel in moral and academic values holistically. Committed teachers can educate students towards becoming the expected human capital. Teachers who have always been idols and inspirations to students cause students to be attracted to learning Mathematics. This will produce mathematically-minded students who

can apply mathematical knowledge in daily life, are educated in its moral values , and can see the beauty of mathematical subjects. Pa (2009) emphasised the role of teachers in the classroom that can influence students. Teachers are a critical factor in determining the success of classroom teaching and learning activities. Without good teachers in terms of moral, intellectual, emotional, creativity, teaching motivation, mentoring skills, and leadership skills, the Mathematics classroom will be less effective. Mathematics is also one of the subjects in STEM.

The approach to strengthening the learning of Science, Technology, Engineering and Mathematics (STEM) is an essential agenda in the Malaysian Education Development Plan (PPPM) 2013-2025 (Ministry of Education Malaysia, 2013). PPPM has set 11 Shifts to achieve the vision of raising the standard of education in the 21st century. Shift 1 demands that the Ministry of Education Malaysia (MOE) provide access to quality education to all students, leading to the need to improve the quality of STEM education (Ministry of Education Malaysia, 2018a). Improving the quality of education through STEM is also emphasised internationally by UNESCO. The United Nations Educational, Scientific and Cultural Organization (UNESCO) also emphasised the globally agreed SDG-4 2030 Sustainable Development Goals for Target 4: Quality education (UNESCO, 2015). UNESCO's primary goal is to ensure inclusive and equitable quality education and provide lifelong learning opportunities for all. UNESCO also prioritises the quality of teaching and learning in the 22nd pillar, which emphasises the need to improve quality and innovation through STEM education. The preparation of teachers in improving the quality of education is highly emphasised to apply STEM in the classroom at all levels of the institution. Studies of the importance of STEM in PdP have been conducted by many researchers (Wahono et al., 2020; Murray, 2019; Kurup et al., 2019; Arsad & Osman, 2019; Adnan et al., 2018; Adnan et al., 2017; English, 2017; Mohd Shahali et al., 2018; al., 2017; English 2016; Honey et al., 2014).

Quality teaching, that is, teachers committed to the education, will plan lessons as best as possible to impact students' learning in primary schools significantly. At the same time, it can educate moral values in teaching, as the saying goes, "let the bamboo bend from the shoot". Mathematics teachers will work hard to design lessons by providing creative and innovative learning activities with STEM integration, providing Teaching Aids (BBM) appropriate to students' abilities, and making fundamental moral values in planning Daily Lesson Plans (LP). Education of moral values will be the basis for the formation of personality and character of students so that it becomes a practice until there is an appreciation of ethical values to the real of career, family and society. The impact is quite significant towards creating prosperity, unity, harmony, economic stability, and a better education system in the future. This is the basis for a balanced human capital desired by the National Education Philosophy.

Idris (2005) states that teachers inspire and be a role model for their students. Teachers are individuals who are close to students in the classroom. Teachers play a role in educating students to produce a balanced human capital in terms of physical, emotional, spiritual and intellectual based on obedience to God. This aligns with the aspirations of the National Philosophy of Education (FPK) and the Philosophy of Teacher Education (FPG). Mathematics Goals in Primary Schools also emphasise that:

> *"KSSR Mathematics aims to form mathematically minded individuals that are to build students' understanding of number concepts, basic skills in calculations, understand simple mathematical ideas and be able to apply mathematical knowledge and skills effectively and responsibly in daily life in problem-solving and decision making, based on attitude and values to be able to deal with challenges in everyday life, in line with the development of science and technology and the challenges of the 21st century "(*Revised SBELC Mathematics, 2018b)

In Malaysia, STEM education is still new. The STEM model was first included in the Curriculum and Assessment Standards Document (DSKP) of the Primary School Standard Curriculum (KSSR) for Mathematics

subjects in 2017. Guidelines for implementing STEM in TnL were also newly introduced in 2016 by MOE (Curriculum Development Division, 2016). The design of the KSSR curriculum is based on six pillars, namely communication, spirituality, attitudes and values, humanity, physical development and aesthetics, science and technology and self-skills. The focus of KSSR is 4M, which is reading, writing, counting and reasoning. The elements emphasised in KSSR include the aspects of creativity and innovation, entrepreneurship, and Information and Communication Technology (ICT) explicitly. This KSSR is expected to improve the quality of primary education to be more relevant to the challenges of today and the 21st century, in which teachers can play an essential role in effective TnL empowerment (Ministry of Education, 2018a).

Pa (2009) also stated that the word value comes from the Old French word *Valere* and the Latin word *valere,* which means "to be strong" or "to be valuable or have certain benefits". Values in Mathematics education that are often talked about respect for teachers, self-discipline, self-esteem, the value of time, cooperation, integrity, courtesy, neatness in dress, and diligent study involving aspects of belief and aspects of understanding, feelings, and human nature behaviour. Value is something that is considered valuable, helpful, and important. A clearly defined value system will form a formal moral code. Bishop (1991) also stated that value in Mathematics education is a deep affective quality that aims to be nurtured by education through Mathematics subjects in school and is an essential component of the affective environment in the classroom. It will result in students becoming more economically oriented and having a global awareness. Mathematics teachers have a role in applying these values in the teaching and learning of Mathematics in the classroom.

Pa (2014) also stressed that in taking a step forward, implementing transformation to develop values in Mathematics, philosophy and psychology education that underlies it should not be set aside. The National Philosophy of Education and an integrated global perspective in line with Islam are the philosophical and psychological foundations to utilise the best practices of value development in improving the quality of Mathematics education in Malaysia. This is an effort to produce Malaysians who appreciate the noble values in the framework of developing a peaceful, prosperous country and blessed by God. Naquib (1995) also stressed that manners refer to a form of physical, emotional and spiritual discipline that ensures that an individual recognises and acknowledges his actual position concerning his potential and physical abilities. Thus, a civilised human being is a human being who knows, is aware and fully realises their responsibility towards everything related to excellence and happiness in this world and the hereafter. It will strive to perform those responsibilities to the best of its ability. Manners are a reflection of justice as imagined by wisdom.

In addition, Hussin (2005) also emphasised that teachers have a role in educating students in teaching and learning to form a generation of noble morals. Morality is a necessary thing in developing good values for an individual. El-Muhammady (1991) also stressed that to deliver education to students, teachers must have a clear goal to build and improve students from the spiritual, mental, and physical aspects. Teaching must be integrated so that the three aspects are balanced. The nurturing of intellect, spiritual values , and physical elements must go hand in hand and not contradict each other. When there is harmony between the three, there is integrated human development. It is the result of this orientation that will produce the best human qualities. Teachers must have a clear view of the integration of knowledge to help the integration in teaching and orienting learning.

Therefore, this study must be made so that moral values become the essential thing in the teaching that should be emphasised and not just inserted as an option in the LP. The development of moral values in Mathematics education should focus on teaching to improve the quality of education. Moral values nurtured at the primary school level will become a culture, lived, and practised by students until they are adults. We want to produce students who are mathematically intelligent, STEM-skilled, and educated in their moral values, character, and personality holistically. This is in line with the aspirations of FPK, FPG, the goals of Mathematics education in primary schools

and MOE in the third Shift of PPPM 2013-2025, which emphasises the community that appreciates values in education to foster unity, harmony, prosperity and improve the quality of education in Malaysia.

## LITERATURE REVIEW

Quality education requires quality teachers who are committed to teaching. The subject of Mathematics is one of the subjects in STEM that should be given priority to producing students who are STEM not only talented but also interested in learning the subject of Mathematics, both moral values and personality through the guidance of teachers.

Thus, this study is based on a model from an Islamic perspective from Al Ghazali (2014), who strongly emphasises moral education in his book *Ihya' Ulumuddin*. This emphasis on morality covering various aspects of human life has been explained in detail in the second volume of his book. While in the first volume of this book, he has elaborated in-depth on the importance of knowledge and education. He stressed that there are four main principles in morality, namely wisdom (*hikmah*), justice (*al-adl*), courage (*al-syaja'ah*) and calling for good and preventing evil (*al-iffah*). He stressed the importance of a teacher having a good personality and practising his knowledge. He also noted that there are eight responsibilities of teachers that need to be practised to produce effective teachers, namely teachers need to have sincerity, love, always advise students, maintain the dignity of students, respect other areas of knowledge, teach according to the level of ability of students, teach clearly to students who are slow to understand and teachers need to practice what is taught.

While Ibn Miskawaih (1994), in his book *Tahdzib al-Akhlaq* also emphasised the importance of morality in the formation of character/morals. He explained that an individual could change his morals/character naturally, and the second way is through training/education before it becomes a practice. He also stated that the basis of this morality is divided into four main principles, namely wisdom (*al-hikmah*) moderate attitude *(iffah*), which is accompanied by the virtues of generosity, justice and courage.

Both figures, Al-Ghazali and Miskawaih, strongly emphasised that continuous training and education will change students' morals for the better. Teachers can implement this education in teaching in the classroom. In the context of this study, teachers not only focus on Mathematics content with STEM integration but also educate/train students towards practising good moral values to make it a practice and live daily life in line with the third shift PPPM. also emphasises creating a society that appreciates values (Ministry of Education, 2018)

Al-Ghazali (2014) defined morality as a state that has been fixed in a person's soul that produces deeds and behaviours efficiently, without considering the mind (first). If morality is good as outlined in the Qur'an and the sunnah refers to the good nature, then it is included in the matter of goodness. Whereas if morality is terrible, then it is included in ugliness. Miskawaih (1994) stated that morality/ character (*khuluq*) is defined as a state of mind. This condition causes the soul to act without thinking about it or considering it deeply. At the same time, Pa (2009) stated that morality refers to the state of mind that encourages an individual to perform actions and behaviours without detailed consideration, deep research or long thinking because such actions or behaviours have become habits and habits for him. Morality refers to all aspects of human life such as self-discipline, daily activities, attitudes, interests, character, lifestyle, thoughts, behaviours, feelings, attitudes and ways of behaving in human interactions.

Bishop (1996) explained that the value of general education, the value of Mathematics education and the importance of Mathematics do not exist in the Mathematics classroom exclusively. It can merge into one, for example, is rational. The rationale can be categorised as the value of general education and the importance of Mathematics education. According to him, these values are based on a sociocultural perspective; values need to be inculcated (inculcate), implanted (implant), conveyed, applied (infuse) or instilled (instil) through mathematical features and individual experiences in the Mathematics classroom. Values supply individuals with cognitive and affective perspectives that shape and change their perceptions of the world and guide them in making life choices. Values possessed by individuals will involve cognition processes

that involve knowledge, observation and awareness of affective variables such as beliefs and attitudes (Bishop, 1988).

The 5 E model that has been introduced by Bybee (2006) is also suitable for use in this study to integrate STEM in the teaching of Mathematics in the classroom. It is an instructional model derived from the Biological Science Curriculum Study (BSCS). This is an innovation because this group of researchers was able to produce a new curriculum for science and health for the primary school model in a learning cycle. Model 5 E is based on a constructivist approach. This model states that students construct new ideas based on their existing beliefs. Model 5 E begins with Engagement, Exploration, Explanation, Elaboration and Evaluation. Each E carries the meaning of each phase in learning. Using this Model 5 E allows teachers to plan student-centred TnL; students are actively involved in TnL Mathematics and ultimately can increase understanding and more meaningful learning when they build new knowledge based on existing knowledge in each phase of learning in the classroom. Bybee (2013) also explained that the purpose of STEM should be translated into the policy education program and ultimately into the concrete teaching of practice in every education institution. He proposed the 4P model, including purposes, programs, policies, and training that represent the unique domains in education to reformate STEM education.

Various previous studies have been carried out in the scope of moral values, moral education, ethics, morals, and reflections from Islam's perspective related to Al-Ghazali. The survey of Hatim et al. (2020) has examined students' perceptions of the formation of morality through applying noble values in art activities. However, the involvement of students in the symptoms of moral decay caused by weak knowledge and appreciation of religion is an issue of concern. Thus, the medium of art is seen to attract students to approach dakwah activities in strengthening the appreciation of faith. This study also identifies the values applied in the implementation of arts dakwah activities in schools and the level of students' appreciation of those values. The application of values should be emphasised in producing excellent and balanced students in academics and personality. Affandi (2020) has studied the concept of Kh Hasyim As'ari's thought values in moral education. This study attempts to explore the concept of KH. Hashim As'ari emphasised moral values. Therefore, the analysis in this article produces a form of alternative education concept that students must possess and an effort to incorporate values based on KH thinking. Hasyim As'ari can be applied in daily life.

Schoen and LaVenia (2019) have conducted a study on teachers' beliefs that will influence the teaching and learning of Mathematics in primary schools, affecting their behaviour and the decisions they make throughout their lives. By focusing on beliefs as cognitive constructs, the purpose of this study was to identify some of the fundamental beliefs about the teaching and learning of Mathematics conducted by primary school Mathematics teachers. Pa and Hashim (2015) have studied the meaning of morality for Year 5 students in primary schools. This is based on a universally integrated approach to identifying the moral understanding possessed by Year Five pupils. In this study, the meaning of ethical behaviour involving students belongs to the good things that society likes and is blessed by God in daily life. Studies have found that moral implications given by students focus on external aspects such as physical, social, and cultural activities. They pay less attention to the internal psychological factors of the individual.

Dollah et al. (2016) made a study to deepen the cultural component, namely applying mathematical values in teachers' teaching in the classroom. The focus of the study is on two mathematical values , namely, the value of rationalism and the importance of objects. Specifically, this study is to answer how the application of the values of rationalism and the values of objectivity occurs in the teaching of Mathematics in primary schools. The study's findings show the tendency of teachers not to plan in writing the lessons to be conducted. Two types of values, namely the importance of rationalism and objectivity, are included in the RPH of classroom teaching. However, the application of values is not exhaustive. The findings of this study can provide a reminder to teachers and educators about the need to implement the application of the importance of rationalism and objectivity more comprehensively to make teaching and

learning more meaningful and further improve students' high-level thinking skills.

Man et al. (2018) studied dealing with the current moral collapse through Islam, referring to Al Ghazali as an honest figure. This illustrates how our society faces a severe problem of moral decay. This study was made to find a solution to the problem of moral decay through the perspective of the Quran and Sunnah. In this regard, the current moral collapse can be addressed if the society adheres to the actual teachings of Islam. The book of Al Ghazali is referred to as the foundation of moral education. According to Al-Ghazali's perspective, Mundiri and Bariroh (2018) have made a study on the role of teachers in the transformative education process. One of the efforts in improving the quality of education is to improve the quality of teachers as leaders who interact directly with students. Teachers are expected to be figures who can manage the learning program using appropriate teaching methods relevant to students' needs. Teachers must have charismatic personality competencies.

However, there are concerns from the aspect of teaching teachers that are less effective, less creative, only use one-way communication, teachers only focus on completing the syllabus and exam-oriented, do not understand how to integrate STEM in Mathematics teaching, lack of training and exposure and still use conventional approaches cause students not interested in learning Mathematics. This is supported by the study of Acharya (2017), and Ahmad et al. (2006) explained that old teaching methods, uninteresting and difficult to understand, become a factor of students not interested in learning Mathematics. Most of the students stated that Mathematics was a complex subject, and many failed in this subject. A study by Ali et al. (2005) found Mathematics notorious as a dry, complex and dull subject. One of the reasons for the existence of this perception is the lack of emphasis given to understanding and applying the value of Mathematics education among students. This study aimed to examine teachers ' knowledge of the value of Mathematics. The findings show three perspectives of teachers' thinking on the meaning of mathematical value, namely the value of Mathematics as a pure value, the value of Mathematics as an intrinsic value and the value of Mathematics as a good value in life.

In the context of this study, the moral values that are meant are the noble values that are nurtured, practised and lived will produce students with noble and praiseworthy morals. Studies of values, morals and ethics for the subject of Mathematics and in all fields of education have been made for decades in Malaysia and abroad (Affandi, 2020; Hatim et al., 2020; Tapsir et al., 2018; Johansson & Einarsdottir, 2018; Ahmad et al., 2017; Dollah et al., 2016; Pa & Hashim, 2015; Pa, 2014; Mustapha & Sidek, 2013; Beerthuizen et al., 2013; Pa, 2009; Pa, 2014; Uysal, 2010; Bishop 2008, Hussin, 2005; Bishop, 1991; Campbell, 1931). Although many studies have been conducted on this moral value, there are still shortcomings in its implementation in teaching in the classroom, especially for the subject of Mathematics. Moral values are a vital element to produce students who are balanced in terms of Physical, Emotional, Spiritual and Intellectual (JERI) to construct student identity and academic excellence.

Thus, this study is relevant and significant in designing a basic model of teaching relevant and meaningful in developing a basic teaching model based on moral values in STEM Mathematics subjects in primary schools to improve the quality of education in Malaysia. Quality and committed teachers will be an inspiration to students and plan lessons well to cultivate moral values in classroom activities. Hopefully, this Mathematics subject, which is difficult, can be turned into a topic that students are interested in when integrated with STEM based on moral values. It is also hoped that this model can be a practical guide for Mathematics teachers in educating students towards a generation with a noble personality and morals, and academic excellence, namely the holistic human capital expected in education in Malaysia.

## RESEARCH OBJECTIVES

To obtain empirical data on the need to design a basic model of teaching based on moral values in STEM Mathematics subjects in primary schools, this study was conducted to meet the objectives of the second phase of the PRP (Design and Development) approach.

Research objective:

i. Designing a Basic Model of Moral-Based Teaching in STEM Mathematics Subjects in Primary Schools according to the experts' agreement.

Research questions:

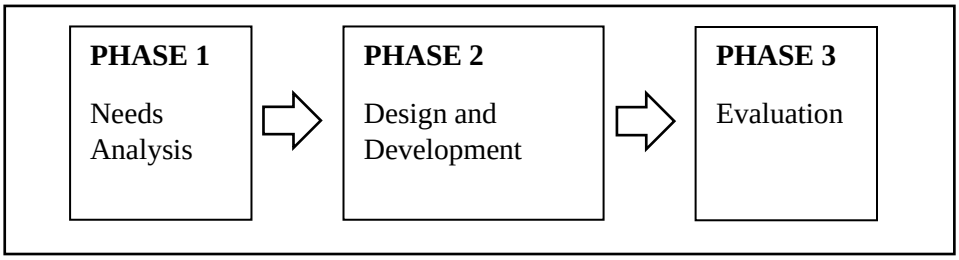
i. What is the expert consensus on the elements of moral values in the basic teaching model based on moral values in STEM Mathematics subjects in primary schools?

## METHODOLOGY

This study aims to design a basic model of teaching based on moral values in STEM Mathematics subjects in primary schools. The design of this study uses the design and development approach (PRP) or better known as Design and Development Research (DDR), by applying three phases in the study, namely needs analysis phase, design and development phase and evaluation phase (Richey & Klien, 2007 & Siraj et al., 2020).

In the second phase of designing this model, the study is a quantitative study that uses the Fuzzy Delphi Method (FDM) to obtain expert agreement in determining and validating the elements of moral values. Richey and Klein (2007) state four phases in DDR: the needs analysis phase, design phase, development phase, and evaluation phase. Siraj et al. (2020) have made modifications into three main phases: the needs analysis phase, design and development phase, and evaluation phase. He has combined the second phase into the design and development phase. Figure 1 below shows the three phases of PRP modification, namely:

Figure 1: Three phases in Design and Development Research (DDR)




The design and development phase is the main phase in this DDR study. Richey & Klein, 2007; Akker et al. 2006 assert three arguments stating that the design and development phase is the most critical phase in developing a product or model because the model developed is educational, model-based and theoretical, which have scientific values. The development of a product or model can change the teaching and learning practices landscape in education.

This phase uses FDM, which was initially based on the classical Delphi method. Olaf Holmer and Norman Dalkey introduced this classical Delphi method in 1953 at the Research and Development Corporation (RAND) for military applications (Yaakub et al., 2020). The Fuzzy set was introduced by Lotfi A. Zadeh (a mathematician) in 1965 and is an extension of the classical set theory in which each element is evaluated based on a binary set response (yes or no). The Fuzzy set theory also allows a gradual assessment of each component studied, and the values found in these fuzzy sets start at 0 and 1 or in-unit intervals (intervals) (0.1) (Zadeh, 1965; 1975). The result of combining the classical Delphi Method and fuzzy set theory is the Fuzzy Delphi Method (FDM). FDM was introduced by Murray et al. (1985), who proposed incorporating fuzziness theory into the Delphi method by using semantic variables. Ishikawa et al. (1993) also proposed two FDM approaches termed, respectively, as the max-min FDM and FDM via fuzzy integration. These approaches attempted to rely on only one round of surveys and utilised particular questions for each survey item.

FDM is a combination between fuzzy set theory and the classical Delphi method. It is an improved instrument based on the classical Delphi method. Among the disadvantages of the Classical Delphi method is the ambiguity of agreement between experts. This makes FDM able to solve problems more effectively in the

field of study and is a more advanced method because it uses the process of triangulation to determine the differences in the level of agreement between experts to produce the results required in the study. FDM was used to obtain the consensus of experts who acted as respondents using quantitative methods (Siraj et al., 2013; 2020). Jamil and Noh (2020) also stated that FDM is used to obtain the consensus of a group of experts who act as study participants. All their views can be taken into account in the study. Next, a quantitative process is used to look at an expert consensus to translate it into empirical data forms.

## RESEARCH PARTICIPANT

All 29 experts in this study are comprised of those who have experience in the field of Mathematics education, values-morals, STEM and model development and education from various educational institutions in Malaysia. All these experts have met the set criteria. In FDM, the most crucial step is the selection of experts as it influences the quality of study results (Taylor & Judd, 1989). Phil (1971) and Oh (1974) state that experts need to have a background and experience in a relevant field of study, contribute their opinions on the purpose of the research and be willing to review their initial considerations to obtain expert agreement. Berliner (2004) also stated that experts had had more than five years of experience and expertise in the field.

Some previous researchers have suggested that the number of FDM specialists is 10-50 respondents (Jones & Twiss, 1978). At the same time, Adler and Ziglio (1996) suggested 10 to 15 experts for FDM. In this study, the researchers used 29 study participants to form an expert panel to validate moral values elements through expert consensus. The researcher concerning six primary sources prepared mapping (mapping) of the initial aspects of moral values were determined by experts consisting of 10 mathematicians, ten moral values experts, 4 STEM experts and 5 model development and education experts referring to the criteria that have been set regarding Table 1 as follows:

Table 1: FDM Expert Criteria

| BIL | EXPERT | FIELD OF EXPERTISE | WORKPLACE | YEARS |
|---|---|---|---|---|
| 1 | EXPERT 1 | Expert Lecturer in Mathematics (Dr.) (Senior Lecturer, Department of Science and Mathematics) | Institut Pendidikan Guru Kampus Perlis | 31 |
| 2 | EXPERT 2 | Mathematics Lecturer (Dr.) (Head of Department, Department of Educational Studies, Faculty of Human Development) | Universiti Pendidikan Sultan Idris | 18 |
| 3 | EXPERT 3 | Mathematics Lecturer (Dr) (Senior Lecturer, Department of Mathematics / Head of Unit, Department of Innovation and Research) | Institut Pendidikan Guru Kampus Darulaman, Kedah | 27 |
| 4 | EXPERT 4 | Expert Lecturer in Mathematics (Assistant Head of Academic Excellence Department) | Institut Pendidikan Guru Kampus Tun Hussein On, Batu Pahat, Johor | 27 |
| 5 | EXPERT 5 | Mathematics Lecturer (Dr.) (Science and Mathematics Faculty) | Universiti Pendidikan Sultan Idris | 19 |
| 6 | EXPERT 6 | Mathematics Resource Teacher (STEM and National School Mathematics Education) | SK Bukit Rahman Putra, Selangor | 13 |
| 7 | EXPERT 7 | Head of Mathematics Panel (National School District Mathematics Coach) | SK Mersing, Johor | 17 |

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|---|---|---|---|---|
| 8 | EXPERT 8 | Mathematics Innovation Teacher (Dr) National School | SK Seri Mutiara, Perak | 18 |
| 9 | EXPERT 9 | Sisc+ Mathematics Officer (Mathematics Education, PPD STEM Coordinator, Curriculum Studies and Development) | PPD Daerah Hilir Perak | 25 |
| 10 | EXPERT 10 | Mathematics teacher (STEM and National School Mathematics Education) | SK Dato Sharif Ahmad, Marudi, Sarawak | 7 |
| 11 | EXPERT 11 | Chief Assistant Director (Dr.) (Department of Science and Mathematics, Assessment and Measurement) | Jabatan Pendidikan Negeri (JPN) Melaka | 25 |
| 12 | EXPERT 12 | Deputy Dean (Higher Education) (Associate Prof Dr) Faculty of Educational Studies (Moral Education and Islamic Education) | Universiti Malaya (UM) | 26 |
| 13 | EXPERT 13 | Senior Lecturer of Islamic Education (Prof. Dr.) Faculty of Educational Studies, (Islamic Education and Moral Education) | Universiti Putra Malaysia (UPM) | 32 |
| 14 | EXPERT 14 | Head of the Department of Moral, Civic and Character Development Studies (Dr.) (Faculty of Humanities) | Universiti Pendidikan Sultan Idris (UPSI) | 15 |
| 15 | EXPERT 15 | Senior Lecturer (Dr.) Department of Educational Studies Faculty of Human Development | Universiti Pendidikan Sultan Idris (UPSI) | 15 |
| 16 | EXPERT 16 | Islamic Education Lecturer (*Subject Matter Expert* Islamic Education) | Kolej Matrikulasi Perak | 28 |
| 17 | EXPERT 17 | Senior Lecturer (Dr.) Faculty of Law (Islamic Financial Law) | Universiti Kebangsaan Malaysia (UKM) | 15 |
| 18 | EXPERT 18 | Senior Lecturer (Associate Prof.) Department of Dakwah and Usuluddin Faculty of Islamic Civilization Studies | Kolej Universiti Islam Antarabangsa Selangor (KUIS) | 23 |
| 19 | EXPERT 19 | Senior Lecturer (Dr.) Department of Educational Studies Faculty of Human Development | Universiti Pendidikan Sultan Idris (UPSI) | 15 |
| 20 | EXPERT 20 | Senior Lecturer (Dr.) *Intra Coordinator Informatics & Analytics Section Malaysian Institute of Information Technology* | Universiti Kuala Lumpur | 19 |
| 21 | EXPERT 21 | Lecturer (Dr) Center for Core Studies & Faculty of Leadership and Management (Appreciation of Ethics and Civilization) | Universiti Sains Islam Malaysia (USIM) | 5 |
| 22 | EXPERT 22 | Lecturer (Prof. Dr.) Assessment and Measurement/ Education | Universiti Pendidikan Sultan Idris (Retired) | 38 |

| | | | | |
|---|---|---|---|---|
| 23 | EXPERT 23 | Lecturer (Dr.)<br>Deputy Head of Department<br>Department of Innovation and Research<br>(Model design and development) | Institut Pendidikan Guru Kampus Darulaman, Kedah | 25 |
| 24 | EXPERT 24 | Senior Lecturer (Dr.)<br>Department of Science and Mathematics Education<br>(STEM Education) | Universiti Malaya (UM) | 18 |
| 25 | EXPERT 25 | Chief Assistant Director (Dr.)<br>Education Policy Planning and Research Division | Pusat STEM Negara | 23 |
| 26 | EXPERT 26 | District Education Counselor (Dr.) | PPD Daerah Hulu Selangor | 30 |
| 27 | EXPERT 27 | Senior Lecturer (Prof. Dr.)<br>faculty of Education<br>(STEM Education) | Universiti Kebangsaan Malaysia (UKM) | 22 |
| 28 | EXPERT 28 | Lecturer (Ts. Prof. Dr.)<br>Deputy dean,<br>School of Graduate Studies | Universiti Putra Malaysia (UPM) | 21 |
| 29 | EXPERT 29 | Lecturer (Ts. Dr.)<br>Faculty of Human Development | Universiti Pendidikan Sultan Idris (UPSI) | 20 |

The initial elements that the researchers had prepared were evaluated by 29 experts to be accepted or rejected by expert consensus. After analysing the data, the elements that the experts have confirmed by consensus will be used as phrases in the ISM to produce a prototype model in the model development phase. A set of questionnaires that have gone through the validation process of Content Validity Index (CVI) analysis, containing 50 elements of moral values, were distributed to experts who have agreed to be appointed.

The expert panel was asked to assess and state the level of agreement on the elements based on the 7-point Likert scale, which will be translated into a fuzzy scale. Next, the data were analysed using the Linguistic Fuzzy Delphi scale according to the expert agreement for each element of moral value accepted or rejected after meeting the three main conditions of FDM, namely threshold value, d should be equal to, or less than 0.2, percentage of the expert agreement should be equal to, or more than 75 % and defuzzification value (alpha α-cut) should be similar to or greater than 0.5.

**RESEARCH INSTRUMENT**

This study uses a questionnaire as an instrument to obtain quantitative data on the elements of moral values. This questionnaire was developed based on document analysis that is mapping from 6 primary sources to get the elements of moral values referring to Al Ghazali (1990), Ibnu Miskawaih (1994), Hussin et al. (2017), Suhid (2009), Siraj (2007) and MOE (1990). The instrument's validity was made by five content experts and one Language expert. Content Validity Index (CVI) validity analysis was used to analyse this questionnaire instrument's face and content validity using a 4 -point ordinal scale. Lyn (1986) suggested using a 4 -point scale to avoid ambivalent or neutral answers. The overall S-CVI/Ave value for the 50 moral value elements instrument is 0.9. It shows that this FDM questionnaire instrument has met a high level of content validity (Polit, Beck & Owen, 2007).

The use of questionnaires meets the criteria and conditions for the benefit of FDM, which involves the use of Mathematical formulas based on three main conditions of FDM to obtain expert consensus. The data for this study were collected using a questionnaire using a 7-point instrument scale in Table 2 as follows:

Table 2: 7-point Instrument Scale

| Instrument scale | Linguistic variable | *Triangular Fuzzy Numbers (m1, m2, m3)* |
|---|---|---|
| 7 | Completely Agree | (0.9, 1.0, 1.0) |
| 6 | Highly Agree | (0.7, 0.9, 1.0) |
| 5 | Agree | (0.5, 0.7, 0.9) |
| 4 | Partially Agree | (0.3, 0.5, 0.7) |
| 3 | Disagree | (0.1, 0.3, 0.5) |
| 2 | Highly Disagree | (0.0, 0.1, 0.3) |
| 1 | Completely Disagree | (0.0, 0.0, 0.1) |

Source: Siraj et al. (2020)

## FINDINGS AND DATA ANALYSIS

Analysis using FDM requires several steps to obtain empirical data. Siraj et al. (2020) stated that the measures of FDM are as follows:

Step 1:

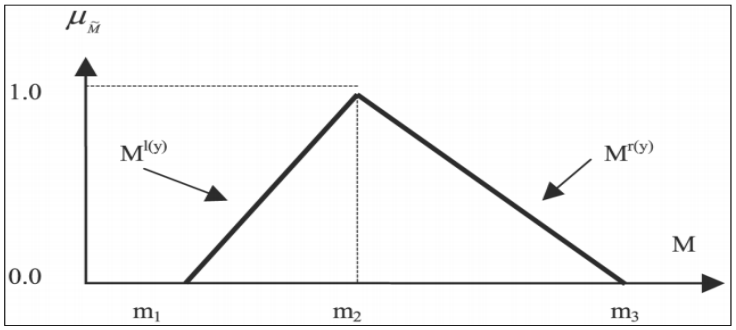
The selection of experts to determine the 50 elements of moral values.

Step 2:

To overcome the problem of ambiguity among expert opinions, the linguistic scale is determined to elucidate respondents 'feedback.

The linguistic scale is similar to the Likert scale, with fuzzy numbers assigned to the response scale based on the Triangular Fuzzy Number (TFN), as shown in Figure 1. Three fuzzy values based on TFN were assigned to consider expert opinion concerns for each response. The three values are shown in Figure 1 consist of three levels of fuzzy, namely maximum value (m1), most reasonable value (m2) and maximum value (m3). Linguistic scales are used to convert linguistic variables into fuzzy numbers. The level of agreement scale must be in an odd number (3, 5 or 7 linguistic levels). The higher the scale level, the more accurate the reaction analysis.

Figure 2 Triangular Fuzzy Number (TFN)




Step 3:

Microsoft Excel included expert responses with a fuzzy number of correspondent scales for each questionnaire item on their views on the model. This is shown in Table 3 to obtain the averages for m1, m2 and m3.

Table 3 Feedbacks from FDM Experts

| Expert | Element 1 | | |
|---|---|---|---|
| Expert 1 | 0.9 | 1 | 1 |
| Expert 2 | 0.9 | 1 | 1 |
| Expert 3 | 0.7 | 0.9 | 1 |
| Expert 4 | 0.9 | 1 | 1 |
| Expert 5 | 0.7 | 0.9 | 1 |

| | | | |
|---|---|---|---|
| Expert 6 | 0.9 | 1 | 1 |
| Expert 7 | 0.9 | 1 | 1 |
| Expert 8 | 0.9 | 1 | 1 |
| Expert 9 | 0.9 | 1 | 1 |
| Expert 10 | 0.9 | 1 | 1 |
| Expert 11 | 0.9 | 1 | 1 |
| Expert 12 | 0.9 | 1 | 1 |
| Expert 13 | 0.9 | 1 | 1 |
| Expert 14 | 0.9 | 1 | 1 |
| Expert 15 | 0.9 | 1 | 1 |
| Expert 16 | 0.7 | 0.9 | 1 |
| Expert 17 | 0.9 | 1 | 1 |
| Expert 18 | 0.5 | 0.7 | 0.9 |
| Expert 19 | 0.7 | 0.9 | 1 |
| Expert 20 | 0.9 | 1 | 1 |
| Expert 21 | 0.9 | 1 | 1 |
| Expert 22 | 0.9 | 1 | 1 |
| Expert 23 | 0.9 | 1 | 1 |
| Expert 24 | 0.9 | 1 | 1 |
| Expert 25 | 0.9 | 1 | 1 |
| Expert 26 | 0.9 | 1 | 1 |
| Expert 27 | 0.9 | 1 | 1 |
| Expert 28 | 0.9 | 1 | 1 |
| Expert 29 | 0.5 | 0.7 | 0.9 |
| *(Average* | **0.845** | **0.966** | **0.993** |
| | m1 | m2 | m3 |

Step 4:

In this fourth step, the calculation of the difference between the expert assessment data and the average value for each item to identify the threshold value (threshold value) d, using the following formula:

$$d(\bar{m}, \bar{n}) = \sqrt{\frac{1}{3}\left[(m_1 - n_1)^2 + (m_2 - n_2)^2 + (m_3 - n_3)^2\right]}$$

Referring to the formula, m1, m2, and m3 are the average values for all expert opinions, while n1, n2 and n3 are the ambiguous values for all three values for each user. The calculation of the threshold value is shown in Table 4 as follows:

Table 4 Threshold Value (d)

| Expert | Element 1 | Element 2 |
|---|---|---|
| Expert 1 | 0.047 | 0.074 |
| Expert 2 | 0.047 | 0.074 |
| Expert 3 | 0.106 | 0.082 |
| Expert 4 | 0.047 | 0.074 |
| Expert 5 | 0.106 | 0.082 |
| Expert 6 | 0.047 | **0.318** |
| Expert 7 | 0.047 | 0.074 |
| Expert 8 | 0.047 | 0.074 |
| Expert 9 | 0.047 | 0.074 |
| Expert 10 | 0.047 | 0.074 |
| Expert 11 | 0.047 | 0.074 |

| | | |
|---|---|---|
| Expert 12 | 0.047 | 0.074 |
| Expert 13 | 0.047 | 0.074 |
| Expert 14 | 0.047 | 0.074 |
| Expert 15 | 0.047 | 0.074 |
| Expert 16 | 0.106 | 0.082 |
| Expert 17 | 0.047 | 0.074 |
| Expert 18 | **0.345** | **0.318** |
| Expert 19 | 0.106 | 0.082 |
| Expert 20 | 0.047 | 0.074 |
| Expert 21 | 0.047 | 0.074 |
| Expert 22 | 0.047 | 0.074 |
| Expert 23 | 0.047 | 0.074 |
| Expert 24 | 0.047 | **0.318** |
| Expert 25 | 0.047 | 0.074 |
| Expert 26 | 0.047 | **0.318** |
| Expert 27 | 0.047 | 0.074 |
| Expert 28 | 0.047 | 0.074 |
| Expert 29 | **0.345** | 0.074 |
| **Average value at each element** | **0.076** | **0.109** |

Threshold values are essential to determine the level of consensus among experts. According to Cheng and Lin (2002), if the threshold value is equal to or less than 0.2, all experts are considered to reach an agreement. A threshold value above 0.2 indicates that the expert's opinion is inconsistent with the idea of other experts. However, what is more important is the overall agreement for all elements. The general consensus of the expert group should be more than 75%. Otherwise, the second round of FDM needs to be run.

Step 5:

Once expert group agreement was reached, aggregate fuzzy evaluations were determined by adding all fuzzy numbers for each element. These steps are shown in Table 5 as follows:

Table 5 Fuzzy evaluations

| **Expert** | **Element 1** | | | **Element 2** | | |
|---|---|---|---|---|---|---|
| Expert 1 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 2 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 3 | 0.7 | 0.9 | 1 | 0.7 | 0.9 | 1 |
| Expert 4 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 5 | 0.7 | 0.9 | 1 | 0.7 | 0.9 | 1 |
| Expert 6 | 0.9 | 1 | 1 | 0.5 | 0.7 | 0.9 |
| Expert 7 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 8 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 9 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 10 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 11 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 12 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 13 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 14 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 15 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Expert 16 | 0.7 | 0.9 | 1 | 0.7 | 0.9 | 1 |
| Expert 17 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 18 | 0.5 | 0.7 | 0.9 | 0.5 | 0.7 | 0.9 |
| Expert 19 | 0.7 | 0.9 | 1 | 0.7 | 0.9 | 1 |
| Expert 20 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 21 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 22 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 23 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 24 | 0.9 | 1 | 1 | 0.5 | 0.7 | 0.9 |
| Expert 25 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 26 | 0.9 | 1 | 1 | 0.5 | 0.7 | 0.9 |
| Expert 27 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 28 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 29 | 0.5 | 0.7 | 0.9 | 0.9 | 1 | 1 |
| Purata | 0.845 | 0.966 | 0.993 | 0.817 | 0.945 | 0.986 |
| **Fuzzy value** | **24.50** | **28.00** | **28.80** | **23.70** | **27.40** | **28.60** |

Step 6:

This fuzzy defuzzification process uses the formula Amax = 1/3 (m1 + m2 + m3) to obtain the defuzzification value. To ensure acceptance of the expert agreement, this third condition must be complied with that the alpha value of α-cut obtained must be equal to or greater than 0.5. Table 6 shows the fuzzy evaluation as follows:

Table 6 Process of value defuzzification

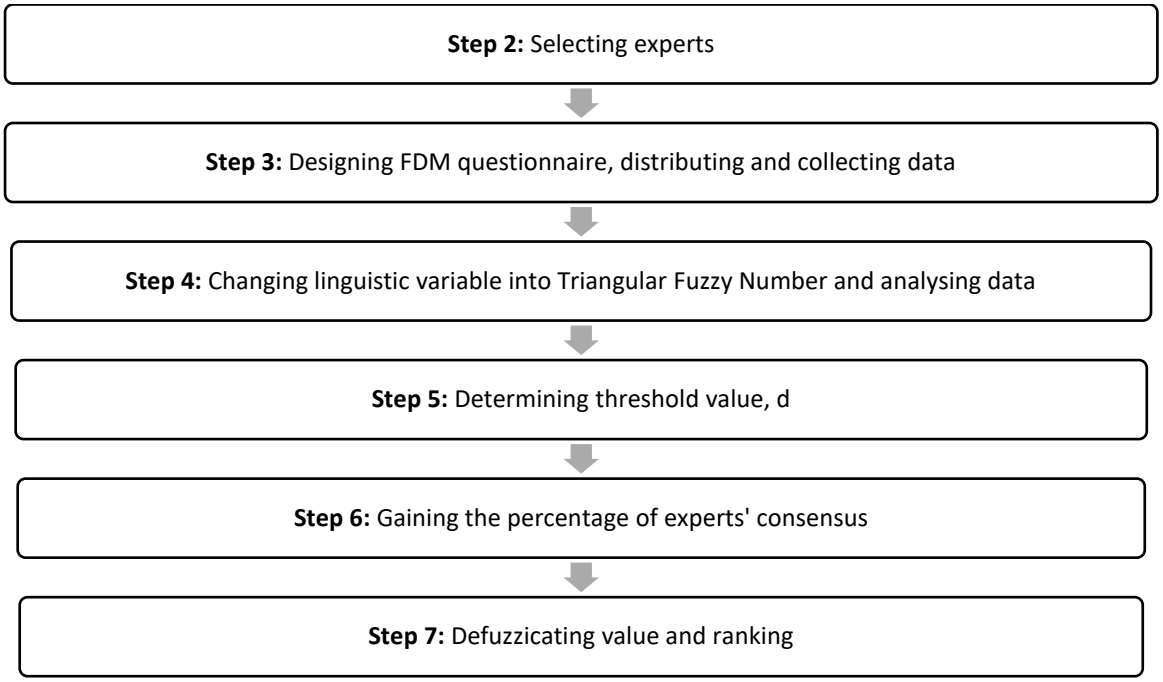
| **Expert** | **Element 1** | | | **Element 2** | | |
|---|---|---|---|---|---|---|
| Expert 1 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 2 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 3 | 0.7 | 0.9 | 1 | 0.7 | 0.9 | 1 |
| Expert 4 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 5 | 0.7 | 0.9 | 1 | 0.7 | 0.9 | 1 |
| Expert 6 | 0.9 | 1 | 1 | 0.5 | 0.7 | 0.9 |
| Expert 7 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 8 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 9 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 10 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 11 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 12 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 13 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 14 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 15 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 16 | 0.7 | 0.9 | 1 | 0.7 | 0.9 | 1 |
| Expert 17 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 18 | 0.5 | 0.7 | 0.9 | 0.5 | 0.7 | 0.9 |
| Expert 19 | 0.7 | 0.9 | 1 | 0.7 | 0.9 | 1 |
| Expert 20 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 21 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 22 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 23 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 24 | 0.9 | 1 | 1 | 0.5 | 0.7 | 0.9 |
| Expert 25 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 26 | 0.9 | 1 | 1 | 0.5 | 0.7 | 0.9 |
| Expert 27 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Expert 28 | 0.9 | 1 | 1 | 0.9 | 1 | 1 |
| Expert 29 | 0.5 | 0.7 | 0.9 | 0.9 | 1 | 1 |
| Purata | 0.845 | 0.966 | 0.993 | 0.817 | 0.945 | 0.986 |
| **Total Fuzzy** | **24.50** | **28.00** | **28.80** | **23.70** | **27.40** | **28.60** |
| **Fuzzy Score (A)** | | **0.934** | | | **0.916** | |

This defuzzification process is essential to classify the elements agreed upon by the agreement of the expert group through the ranking of the elements. The element with the highest Defuzzification value is in the most elevated position in priority to be considered output. However, in this study, the position of elements agreed by the expert group was not used because the calculation of defuzzification value and position was used to identify the elements in the questionnaire that the experts unanimously approved in designing the basic model of teaching based on moral values in STEM Mathematics subjects in primary schools. The 38 elements accepted in FDM through expert agreement will be used as phrases in Interpretive Structural Modeling (ISM) to see the priority of the elements in the model development phase.

Table 3 Steps in Analysing FDM Data

Step 1 in this FDM is the data from the expert background questionnaire, as shown in Table 1. The steps of data analysis using FDM application starting from Step 2 to Step 7 are shown in Figure 3 as follows:




## DISCUSSION

A total of 29 experts have agreed to be involved in the study using this FDM. The expert panel consists of mathematics, Moral Values, STEM, model development and education. Using a 7 - linguistic point scale, study participants' responses (experts) were analysed using the Fuzzy Delphi Method (FDM). A total of 38 elements were accepted (76%), and 12 elements were rejected (24%) according to the agreement of 29 experts after fulfilling the three main conditions of FDM. The results of FDM analysis based on the expert agreement are shown in Table 7 as follows:

Table 7 Results of Final Analysis of FDM Based on Expert Consensus

| Bil. | Element | Rules of Triangular *Fuzzy Numbers* (TFN) | | Rules of *Defuzzification Process* | | | | Experts' Consensus | Ranking |
|---|---|---|---|---|---|---|---|---|---|
| | | Threshold, d | Percentage of Experts' Consensus | m1 | m2 | m3 | *Fuzzy Score (A)* | | |
| 1 | Honest | 0.076 | 93% | 0.845 | 0.966 | 0.993 | 0.934 | **ACCEPT** | 2 |
| 2 | Love | 0.109 | 86% | 0.817 | 0.945 | 0.986 | 0.916 | **ACCEPT** | 6 |
| 3 | Advise | **0.160** | 72% | 0.734 | 0.886 | 0.966 | 0.862 | **REJECT** | |
| 4 | Do not underestimate | 0.135 | 79% | 0.783 | 0.921 | 0.979 | 0.894 | **ACCEPT** | 20 |
| 5 | Practising knowledge | 0.140 | 86% | 0.797 | 0.928 | 0.972 | 0.899 | **ACCEPT** | 18 |
| 6 | Teach according to the ability of students | 0.152 | 83% | 0.790 | 0.921 | 0.969 | 0.893 | **ACCEPT** | 21 |
| 7 | Teach clearly | 0.104 | 93% | 0.838 | 0.955 | 0.979 | 0.924 | **ACCEPT** | 4 |
| 8 | Takwa | 0.185 | 76% | 0.748 | 0.890 | 0.955 | 0.864 | **ACCEPT** | 35 |
| 9 | Zuhud | **0.204** | 90% | 0.693 | 0.852 | 0.941 | 0.829 | **REJECT** | |
| 10 | Patient | 0.124 | 90% | 0.817 | 0.941 | 0.976 | 0.911 | **ACCEPT** | 10 |
| 11 | Repentance | **0.236** | 41% | 0.672 | 0.831 | 0.924 | 0.809 | **REJECT** | |
| 12 | Reda | 0.188 | 79% | 0.741 | 0.886 | 0.952 | 0.860 | **ACCEPT** | 37 |
| 13 | '*Amar Makruf Nahi Mungkar'* | 0.181 | 83% | 0.783 | 0.910 | 0.955 | 0.883 | **ACCEPT** | 27 |
| 14 | Generous | 0.173 | 76% | 0.714 | 0.872 | 0.955 | 0.847 | **ACCEPT** | 38 |
| 15 | Integrity | 0.081 | 93% | 0.838 | 0.962 | 0.993 | 0.931 | **ACCEPT** | 3 |
| 16 | Just | 0.126 | 86% | 0.797 | 0.931 | 0.979 | 0.902 | **ACCEPT** | 13 |
| 17 | Thank goodness | 0.124 | 83% | 0.790 | 0.928 | 0.983 | 0.900 | **ACCEPT** | 16 |
| 18 | A clean soul | 0.114 | 86% | 0.790 | 0.931 | 0.986 | 0.902 | **ACCEPT** | 13 |
| 19 | Manage time | 0.109 | 86% | 0.817 | 0.945 | 0.986 | 0.916 | **ACCEPT** | 8 |
| 20 | Keep promises | 0.149 | 83% | 0.803 | 0.928 | 0.969 | 0.900 | **ACCEPT** | 16 |
| 21 | Tafakur (observations) | 0.152 | 83% | 0.790 | 0.921 | 0.969 | 0.893 | **ACCEPT** | 21 |
| 22 | Tawakal | **0.203** | 79% | 0.734 | 0.879 | 0.945 | 0.853 | **REJECT** | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 23 | Tawaduk (humble) | 0.169 | 76% | 0.748 | 0.893 | 0.962 | 0.868 | **ACCEPT** | 33 |
| 24 | Hardworking | 0.106 | 86% | 0.824 | 0.948 | 0.986 | 0.920 | **ACCEPT** | 5 |
| 25 | Istiqamah | 0.163 | 83% | 0.803 | 0.924 | 0.962 | 0.897 | **ACCEPT** | 19 |
| 26 | Ihsan (kind) | 0.137 | 83% | 0.797 | 0.928 | 0.976 | 0.900 | **ACCEPT** | 15 |
| 27 | Trying | 0.133 | 79% | 0.803 | 0.931 | 0.979 | 0.905 | **ACCEPT** | 12 |
| 28 | Courage | 0.151 | 83% | 0.776 | 0.914 | 0.969 | 0.886 | **ACCEPT** | 25 |
| 29 | Intelligent | 0.068 | 97% | 0.845 | 0.969 | 0.997 | 0.937 | **ACCEPT** | 1 |
| 30 | Discipline | 0.111 | 86% | 0.810 | 0.941 | 0.986 | 0.913 | **ACCEPT** | 9 |
| 31 | Respect | 0.164 | 76% | 0.734 | 0.886 | 0.962 | 0.861 | **ACCEPT** | 36 |
| 32 | Remembering death | **0.201** | 93% | 0.686 | 0.848 | 0.941 | 0.825 | **REJECT** | |
| 33 | Maintain cleanliness | 0.141 | 79% | 0.748 | 0.900 | 0.972 | 0.874 | **ACCEPT** | 30 |
| 34 | Cooperative | 0.116 | 90% | 0.797 | 0.934 | 0.983 | 0.905 | **ACCEPT** | 11 |
| 35 | Calm | 0.153 | 86% | 0.772 | 0.910 | 0.966 | 0.883 | **ACCEPT** | 28 |
| 36 | Shy | **0.242** | **41%** | 0.690 | 0.841 | 0.924 | 0.818 | **REJECT** | |
| 37 | Optimist | 0.171 | 76% | 0.755 | 0.897 | 0.962 | 0.871 | **ACCEPT** | 32 |
| 38 | Forgiving | 0.136 | 83% | 0.769 | 0.914 | 0.976 | 0.886 | **ACCEPT** | 26 |
| 39 | Polite | **0.212** | 76% | 0.728 | 0.872 | 0.941 | 0.847 | **REJECT** | |
| 40 | Simple | **0.219** | 76% | 0.724 | 0.866 | 0.934 | 0.841 | **REJECT** | |
| 41 | Good food | 0.196 | **69%** | 0.714 | 0.866 | 0.948 | 0.843 | **REJECT** | |
| 42 | Responsible | 0.152 | 83% | 0.783 | 0.917 | 0.969 | 0.890 | **ACCEPT** | 24 |
| 43 | Make good friends | 0.150 | 76% | 0.741 | 0.893 | 0.969 | 0.868 | **ACCEPT** | 33 |
| 44 | Think rationally | 0.165 | 83% | 0.797 | 0.921 | 0.962 | 0.893 | **ACCEPT** | 21 |
| 45 | Big heart | 0.162 | 79% | 0.769 | 0.907 | 0.966 | 0.880 | **ACCEPT** | 29 |
| 46 | Rational | 0.109 | 86% | 0.817 | 0.945 | 0.986 | 0.916 | **ACCEPT** | 6 |
| 47 | Social interaction | 0.163 | 83% | 0.755 | 0.900 | 0.962 | 0.872 | **ACCEPT** | 31 |
| 48 | Freedom | **0.229** | **48%** | 0.672 | 0.834 | 0.928 | 0.811 | **REJECT** | |
| 49 | Strong memory | **0.249** | 90% | 0.721 | 0.859 | 0.921 | 0.833 | **REJECT** | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 50 | Reflective | **0.267** | 79% | 0.738 | 0.862 | 0.917 | 0.839 | **REJECT** |

Values in bold in Table 5 above are elements that exceed a threshold value of 0.2 or a percentage of expert agreement of less than 75%, causing the element to be rejected. This indicates expert opinions that are inconsistent with the views of other experts for a particular element. If it does not meet one of the main conditions of FDM, the element will be rejected. Accepted elements are elements that meet all three conditions of FDM, namely the threshold value (threshold value) d should be equal to or less than 0.2, the percentage of the expert agreement should be equal to or more than 75%, and defuzzification value (alpha α-cut) should be similar to or more of 0.5.

The score Value (A) defuzzification value of each of these elements exceeds 0.5 as specified in the FDM conditions. The lowest value is 0.847 elements (generous) and the highest value is 0.945 elements (wisdom /Arif). Some elements are rejected because they do not meet the two main conditions of FDM, namely element 36 (shame) at a threshold value of 0.242 and an expert agreement percentage of 41%. Element 48 (freedom) at a threshold value of 0.229 and an expert agreement percentage of 48%. It is clear here that the threshold value of these two elements is less than 0.2, and the percentage of expert agreement is less than 75%. The nine elements that are rejected are elements 3, 9, 12, 22, 32, 39, 40, 49 and 50, which are elements because their threshold value is more than 0.2 and only one element is rejected because the percentage of expert agreement is less than 75% which is the 41st element (good food). The number of elements rejected based on the expert agreement is 12 elements. These rejected elements are inappropriate elements to be included in the basic model of teaching based on moral values in STEM Mathematics subjects according to the consensus assessment of 29 experts of Mathematics education, moral values, STEM, model development and education.

The elements received through the expert agreement using FDM are 38 elements which consist of elements of sincerity, love, not belittling, practising knowledge, teaching according to the ability of students, teaching, piety, patience, calm, the nature of *'Amar Makruf nahi mungkar'*, generous, integrity, fair, grateful, clean soul, managing time, keeping promises, contemplation (making observations), tawaduk (humility), earnestness, istiqamah, kindness, striving, courage, wisdom, disciplined, respectful, caring cleanliness, cooperation, calm, optimism, forgiveness, responsibility, making good friends, reasoning, big-hearted, rational and social interaction are important elements that need to be included in this basic model of teaching based on moral values through expert assessment agreement has been appointed using FDM. This research question has been answered to identify the concentration of experts on the elements in designing this model. Various studies have been conducted using FDM (Beram et al., 2021; Ismail et al., 2021; Bui et al., 2020; Hidayatul Farihah et al., 2020; Tsai et al., 2020).

Al Ghazali (2014) stressed that he attaches great importance to education by instilling good manners in children to " judge between right and wrong". Fostering the nature of mahmudah among students should start with education. Al-Ghazali stressed that the knowledge of moral values is related to the heart; knowledge can help a person choose to do good and vice versa. Ibn Miskawaih (1994) has also strengthened the field of moral philosophy. He has debated the idea of practical moral philosophy by emphasising the aspects of training in moral purification. According to Miskawih, morality is responsive and moral education is vital in building a noble personality and morals. Pa (2014) emphasises that to achieve success in value development in Mathematics education, we need to practice the principles of excellence and moderation in a balanced and integrated manner. The construction of good values in Mathematics education is to achieve worldly and ukhrawi happiness. Integrity is a determining factor for human success.

## CONCLUSION

This study shows that the element of moral values should be fundamental in the teaching of teachers, -teachers of Mathematics. Teachers need to play a role in inculcating moral values in teaching in classroom activities. The

integration of Mathematics, STEM and moral values is seen as very significant and relevant in producing students who excel in common sense holistically. Thus, this study seeks to design a model based on moral values to improve the quality of education in Malaysia based on obedience to God in line with the National Education Philosophy, the goals of Revised Mathematics SBELC (2019) and the third shift PPPM 2013-2025 which emphasizes a society that has values .

**RUJUKAN**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