Neutrosophic Theory Framework for Building Mathematics Teachers Capacity in Assessment of High School Students in the United Arab Emirates

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Abstract

Better classroom evaluation may have positive effects on students' learning, according to research and practice from the past ten years. United Arab Emirates (UAE) values the assessment of procedures used in teaching, as an integral part in the evaluation of their effectiveness. Through evaluation, the results realized, help in measuring the effectiveness of curricula and methods used in teaching. This, therefore, affects stakeholders in education, the teachers, and most importantly, the students. This study aims at cross-examining students' performance in mathematics, especially at the high school level, in the UAE. Also, this evaluation has a multi-criteria so the concept of multi-criteria decision-making is used in this paper. But this process has vague and uncertain information, so the neutrosophic theory is used to solve this problem. The neutrosophic sets integrated with the MCDM methodology. The neutrosophic AHP method is used to compute the weights of criteria and evaluate the classroom.

Keywords: Classroom assessment; outcomes of learning; teaching methods in mathematics; teacher assessment competency; Neutrosophic theory; MCDM; AHP.

1. Introduction

The UAE values the importance of evaluating students and their learning outcomes in order to enhance effective learning for all students. The evaluation brings to light most essential issues affecting effective learning outcomes in its results to assist in reinforcing learning especially in mathematics. According to Pegg [1]teachers coming up with achievable learning goals, communicating them effectively and following up on the students' progress, is one the most essential issue at hand. These goals should aim at improving learning for students and help teachers to effectively evaluate their students in a fair and efficient way. Achieving this, will help form an effective design for professional learning. Therefore, teacher capacity structure for evaluation is an integral part in enhancing professional and effective learning outcomes.

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Unpredictability in the change of culture, society, technology, economics, politics and the environment force stakeholders in the education sector to rethink and remodel their structure and their aspects of learning. This unpredictability has left educators unsure of what they will face in the future. This has been among the major inhibitors of achieving professional learning. In the 20th century, evaluating student outcomes was considered as a way of forming predictable patterns and getting learning indicators from students. Usually, teachers taught and tested students' knowledge on the unit taught; provided the results and verdict to students, based on the test, then, teachers would proceed to the next topic [2-4].

Recently, questions about the effectiveness of this methodology have been brought up. This is mainly due to the social expectations for learning in the present and how they differ from the past years. This is because, through cognitive science, stakeholders in education have been able to challenge the traditional assessment criteria used in confirming learning, and challenging the current nature of learning.

In reference to Kandeel [5], it is essential for all students to learn beyond the basic skills, especially in the upper secondary school. However, unlike the past years, where graduating in upper school was considered for a few, now, it's essential for all. It is important to realize that, in the present education community, it is required for them to ensure that future graduates have attained skills in: problem solving, critical thinking and communication, to meet the changing societal challenges in: economics, sociology and technology. Previously, learning was based on explicitly taught particles, decentralized and accumulation of hierarchical. Currently, learning is viewed as a process of connecting new information with what one already knows, in order to build an understanding. This helps in creating a personal attachment with whatever students learn. This understanding is built in various methods depending on one's learning style, experiences and preferences [5].

A reliable study done in Jarrah & Diab [6], provides evidence that support the effectiveness of classroom assessment on learning. This research analyzed over 150 studies that support assessment and learning. In that, evaluating student learning outcomes in the classroom, promotes improved learning, and the student's achievement. This article will weigh out on an assessment necessary to be undertaken daily, in every classroom. Its design aims at providing a framework for critical thinking for teachers and education stakeholders, to come up with and use classroom assessments, to create favorable conditions for learning for individual students, despite their differences.

In 1965, Zadeh published a paper in which he introduced the fuzzy theory as a way to address uncertainty and fuzziness. To begin, fuzzy sets are merely comprised of the membership function. After then, a wide variety of fuzzy sets are created to more effectively deal with unknowns and ambiguity. The intuitionistic fuzzy sets, often known as IFSs, are one of these fuzzy sets. IFSs are a generalization of fuzzy sets that can be described by both the membership and non-membership functions. IFSs are also known as indistinguishable fuzzy sets. Smarandache proposes neutrosophic logic as a more sophisticated form of IFSs to deal with ambiguity in a more complete manner[7]. He does this by expanding fuzzy logic with a new function named "uncertainty"[8-10].

The approach known as AHP relies on the logic of organizing an issue in hierarchies and then assessing each element in the hierarchy via pairwise comparisons. The basis for it was laid by Myers and Alpert, and it was developed and systematized by Thomas Saaty in the 1970s [11]. Systematization is what brought the AHP method to the literature. While AHP is a strategy that is widely used in MCDM situations, there are occasions when it is unable to accurately represent human reasoning[12-13]. In contrast to traditional AHP, N-AHP can effectively include human cognition in the process of decision-making and vividly communicate ambiguity via the use of three variables[14-16].

2. Purpose of the Study and the Research Questions

This study was designed purposefully to understand the assessment forms. With this, the study will come up with a teacher capacity framework, useful in assessing mathematics studies in high school, in the UAE.

The study aims at answering the following questions:

1. The views and effectiveness of assessment in the current education?

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2. What are the learning outcomes in the UAE, due to the basic capacity framework of teachers in assessing students in mathematics?

The education system of the United Arab Emirates (UAE) has been divided into three groups, known as primary, secondary, and high secondary, respectively. The academic curriculum of public schools is Arabic, while private schools follow 17 different curriculums. The national curriculum followed by schools is from the India, U.S., U.K., and the Ministry of Education (MoE) supervises up to 90 percent of the student population in private schools. The remainder of the curriculum comprises International Baccalaureate (IB), German, Iranian, Canadian, Pakistani, French, Philippines, Russian, Japanese, and Iranian. The MoE secondary and primary education is provided for all United Arab Emirates (UAE) citizens and obligatory until the ninth grade [17]. the current educational construction, which was recognized in the early 1970s, is a four-tier system casing education for 14 years, as follows:

Playgroup – 4 to 5 years old (1-2 years program).

Primary – 6 to 12 years old (6 years program).

Introductory – 12 to 15 years old (3 years program).

Secondary – 15 to 18 years old (3 years program).

More than 67% of the people who live in the United Arab Emirates live in Dubai and Abu Dhabi, and 16% of them are Emirati. 91% of the people in Dubai and 55% of the population in Abu Dhabi are foreign immigrants. The United Arab Emirates (UAE) had 580 private schools for the academic year 2020–2021, with the majority of them located in Abu Dhabi (122) and Dubai (185). In Abu Dhabi and Dubai, respectively, there were around 241,493 and 273,599 kids who enrolled in private schools, as opposed to 238,632 and 265,299 respectively in 2020/2021. The Ministry of Education has established a vision that promotes creative capabilities and places a greater emphasis on students and self-learning abilities regardless of the age of students or the curriculum that is used [18].

This study integrated the neutrosophic sets with the MCDM method to assess student performance. The AHP method uses to show the weights of performance students in this paper. There are many conflicting criteria, so the concept of MCDM is used in this paper.

Zadeh came up with the fuzzy sets theory in an attempt to find a solution to the problem of uncertainty. Since its inception in 1965, it has been developed further and expanded into a variety of forms. Again, Zadeh was the one who pioneered the idea of using type-2 fuzzy sets to improve the mathematical depiction of imprecision in data. This was done so that mathematical operations could be performed more accurately. Then, in 1986, Atanassov presented the idea of intuitionistic fuzzy sets. This is a notion that simultaneously incorporates membership and non-membership degrees. Smarandache then presents neutrosophic sets, which provide a domain area that is made up of three separate subsets that reflect different kinds of uncertainty. This domain area is offered by Smarandache. Neutrosophic sets (NS) are characterized as the sets where every component in the universe has a degree of truthiness, indeterminacy, and falsehood, which are between 0 and 1, and where these levels are subsets of the NS that are independent of each other. Neutrosophic sets are also known as neutrosophic subsets. In the NS, impreciseness is expressed as truth and falsity functions, but the indeterminacy function represents degrees of belongingness and non-belongingness and differentiates between absoluteness and relativeness. Neutrosophic sets can deal with the unpredictability of the system and cut down on the paralysis brought on by conflicting information thanks to this notation. As a result, one might argue that this capacity is the single most significant benefit offered by neutrosophic sets in comparison to the many other forms of fuzzy extensions. By making use of these three operations, NS can create a domain area. This area makes it possible for various kinds of mathematical operations to be carried out separately despite the presence of uncertainty.

The AHP was first conceived and developed by Saaty. It is a well-known technique for dealing with difficult issues by first breaking them down into more manageable sub-issues and then combining the answers to these individual issues. Making sure that the judgments are consistent is given a significant amount of weight in this methodology, which depends on making comparisons between different pairs of experts.

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The stages of the neutrosophic AHP technique have been executed using neutrosophic processes, and the concept can yield neutrosophic weights. These are all aspects of the neutrosophic computations that take place throughout all of the concept's processes. For deneutrosophication, after building the pairwise contrast matrix, pairwise contrast matrices are created concerning the information at hand based on a neutrosophic scale consisting of linguistic expressions and the associated neutrosophic numbers. Following this step, the neutrosophic numbers are deneutrosophicated, and the crisp values are gathered. Following this procedure, the phases of the traditional AHP approach are carried out to accumulate the weights. Only the crisp weights of the criteria may be produced by using this idea. To perform parameter-based calculations across all of the phases in the idea, each subset of the neutrosophic sets was put through its own set of operations. Neutrosophic weights may be generated by the idea thanks to its unique capabilities. When these three concept-based studies are analyzed, their validity and applicability are largely shown by the comparative analyses that are included within the papers that were studied. Based on this, it is possible to say that there is no absolute superiority one over another and that there may be some benefits of using these notions depending on the application domain. However, doing the simulations inside the same application will give findings that are more useful in terms of their applicability.

3. Research method

The study was used practical methods, such as; observations, interviews, and refer to, teachers, experts, students, and other education stakeholders. In addition, the study utilized also take into consideration an in-depth analysis of other theoretical studies.

3.1 Basic capacity framework of assessment mathematics students in the UAE

Schools in the United Arab Emirates have collaborated with other institutions to increase teachers' proficiency in classroom assessment and have created products and training resources in this area. The Basic capacity framework of assessment mathematics students in the UAE consist from 13 aspects as in figure 1 below.

3.2 Teacher’s Mathematics Capacities

Mathematics competence is among the most complex topics for teachers. The teacher’s ability in mathematics, also serves as a teaching tool, to help in enhancing understanding of mathematical concepts to a student. Various characteristics and skills come to play, when solving mathematical problems, which are unique amongst different people. Helping students understand and gain mathematical ideas, by helping them solve problems within their environments basing on mathematical topics taught; and to assist student gain a profound understanding on the area of topic concerned. This can easily be characterized by learning through participation in: discovery, verification, and also, guesswork.

Educators in mathematics come into terms with the notion that it is important to teach more than mathematics, in order for students to enhance their learning. Therefore, teachers are required to be effective problem solvers. This is what makes problem solving instructions, a difficult topic to teach. Therefore, teachers relating to events experienced in problem solving will play a good deal in developing critical thinking and enhancing professional learning. In the past years, many writers have tried to unravel problem solving approach in teaching mathematics.

3.3 Mathematical Modeling Capabilities

Haj-Yahya & Olsher [19]indicates that applying mathematical thinking to solve wide range problems in the daily situations of life is the definition of being competent in mathematics and involves both spatial and logical thinking. Gaining knowledge in the process and activity, base the understanding of mathematics. Therefore, being competent in mathematics, is measured by one’s willingness, and ability to use mathematics in solving their daily issues in life. Using mathematics according to its expected modeling capabilities in illustrating, suggesting and solving our daily life challenges, or rather situations, forms the basis and structure of mathematical competency [20]. Also, the ability to solve problems by cognitive expression is similarly viewed as competence. That is, the ability to successfully meet the challenges in a particular situation, proving that competency development is continuing process.

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According to Buchholtz et al [20]. modeling is practical learning activity, meaning that, it is a representation of the actual world, and solving problems in it. In relation to this, students are able to use various representations in mathematics and select the required mathematical methods to come up with solutions for real world situations. In addition, Buchholtz, et al [20] supports these facts by confirming that, a student, ready to use all necessary parts of the mathematical modeling process in the actual world, is the perfect competency model for a student.

3.4 Teachers' Linguistic Abilities to Teach Math

Understanding common terminologies used to teach mathematics and using them to reinforce students' ideas play an essential role in enhancing learning. This is can be a bit challenging for teachers in introducing new knowledge in mathematics and their precise meanings which teachers are already familiar with. Teaching differential meaning of symbols and terminologies can effectively enhance professional learning. Teachers also need to gaining support in understanding these symbols and terminologies in order to effectively help the student understand them. This can be achieved by reaching out for support and practicing to gain confidence in using them through understanding, in order to delivering accurate math instructions. It is important to understand that mathematical terminologies may have their own unique mathematical meaning. This helps student to be critical in their thinking [21].

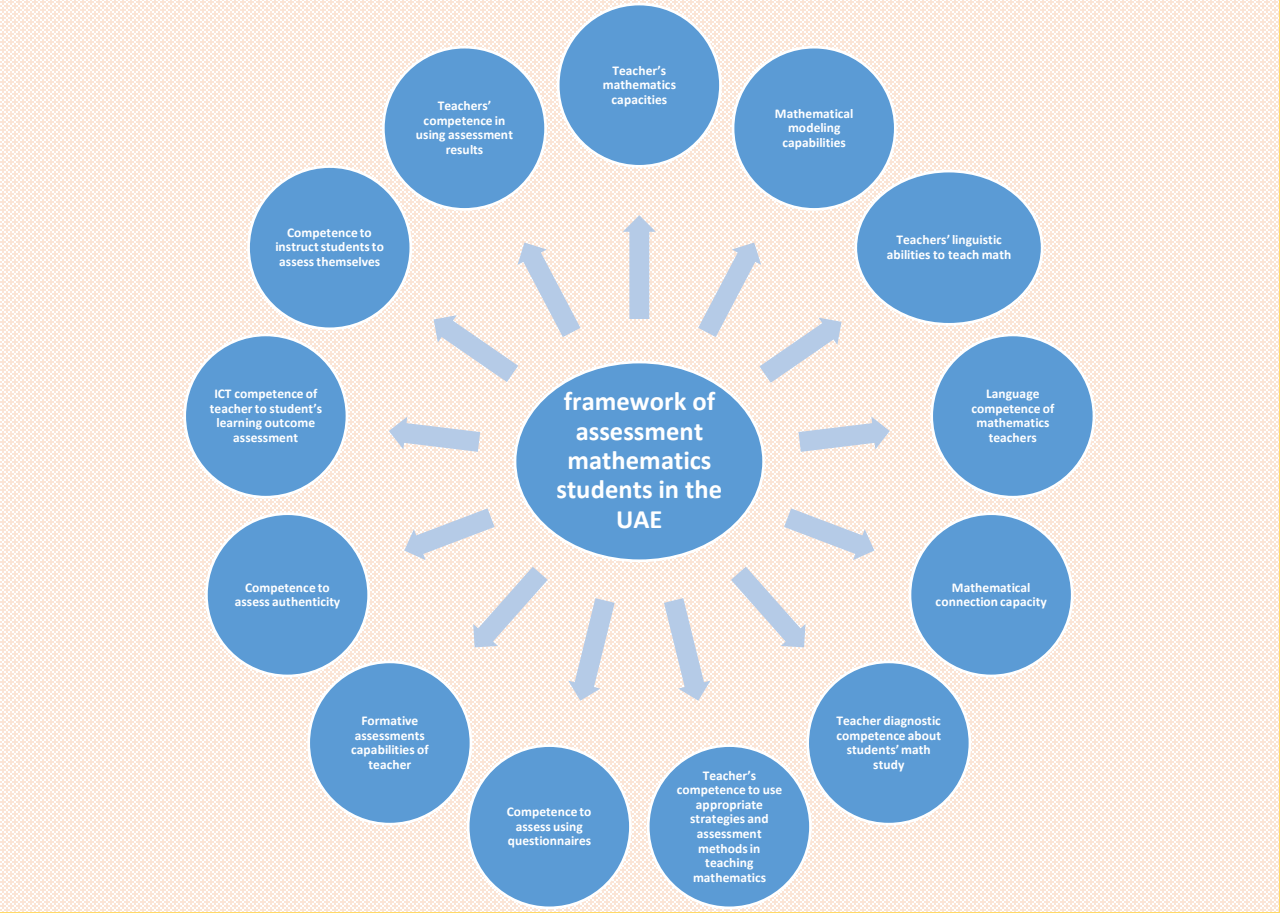

Figure 1: Framework of assessment mathematics students in the UAE

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3.5 Language Competence of Mathematics Teachers

Teachers should understand mathematics terminologies in order to successfully deliver or share it to students. Students are expected to learn new knowledge; the precise meaning of words and interact with new mathematical symbols. This can be successfully taught to students, if teachers are competent enough in using the expected language. Teaching differential learning in terms of symbols and terminologies can serve as a great advantage to students. Practicing and asking for support in use of language in math instruction can positively impact struggling teachers' confidence. Accurate mathematical instruction will help students approach mathematical problems more carefully about the idea.

3.6 Mathematical Connection Capacity

Exploring mathematical connections can play vital role for both teachers and students in improving learning. Providing teachers with tutorials, suggestions and strategies will help teachers develop ways of approaching mathematical problems to students. Building this way of thinking in students will not only improve their learning, but also develop an understanding of mathematical connections. This in return will transform students into being independent problem solvers.

Recognizing and using connections between math ideas and understanding mathematical ideas, is the ability to connect mathematics to math instructions. This builds a coherent whole, where one knows and uses math in the appropriate mathematical context, this form the basis of a competent teacher.

3.7 Teacher Diagnostic Competence about Students' Math Study

A diagnostic assessment refers to the technique of testing what students already knows, before initiating the program of study. It is important to analyze a student's set of skills and knowledge in order to effectively monitor their progress while participating in the program. This process should take note of individual barriers and learning needs, in order to design an effective individualized study program.

According to Buchholtz, et al [20], the aim of assessment should focus on learning about a student's strengths and weaknesses in relevance to the skills been taught. After carrying out this assessment, a teacher should provide diagnostic feedback to their student to promote positive learning outcomes. It is essential to realize that, the success of the program in promoting learning, is realized when both the teacher and student use the diagnostic feedback. Using diagnostic feedback should be based on an individual structural level, such as: school, community and class. In addition, it also relies on a variety of variables on an individual level. A good diagnostic feedback aims at focusing on more than one cognitive dimension; it should also examine characteristics such as student's attitude towards learning, evaluation and goal orientation.

Studies have been done connecting student orientation and how they approach diagnostic feedback. The study will take an in-depth look at student orientation as the gateway of understanding how learners interpret feedback, and its effect on learning. In addition, the study will analyze other attributes in learners such as: attitude and direction, and how they are shaped through various interactions with learners, parents, teachers and societal norms. Research by Bostic et al [22].supports the fact that teachers understand that they expect students to come from a various background, with different experiences, culture, and skills sets, specifically in mathematics. Therefore, diagnostic assessment should involve understanding every aspect of a student and relating how its content been taught will be successfully delivered. This form of examination should be done in advance, before the start of any actual learning, either, as an introductory class or, at the end of an introductory lesson of a course. When done in advance, it can be two weeks before the start of a course. This can be in form of a survey to be submitted on the first day of class. Diagnostic assessment main goal is to help in preparing content for distribution.

Diagnostic assessment should not be used to rank students and classify student. Through this, teachers are able to estimate how familiar their students are with content a teacher is about to teach. This will help in knowing how much background information is needed to help students gain an understanding on what is been taught. While teaching, teachers require to be keen on students not losing, while introducing a new concept. If the students are

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well familiar with the concept been taught, teacher can amend the curriculum to spend less time in that area of topic, hence provide more time for more challenging topics.

3.8 Teacher's Competence to Use Appropriate Strategies and Assessment Methods in Teaching Mathematics

Evidence-based instructional strategies play a major role in impacting learning outcomes for students. Teachers with the skill to use the necessary appropriate strategies and methods of assessment in teaching math, will impact student positively, and improve their performance.

3.9 Competence to Assess Using Questionnaires

An objective test evaluation helps to separate student from student. It is aimed at identifying knowledge; amount of experiences; education and some specific behaviors in the student. This test can either be marked right or wrong. Students can identify their relevant knowledge through the objective test evaluation. It shares some similarities to subjective test whereby, both are judged by giving opinions using the specified criteria. As for target test, they are easy to formulate, mark and issue a measurable feedback. These various forms of assessment are necessary for teachers to be familiar with in helping to effectively evaluate a student's academic performance.

3.10 Formative Assessments Capabilities of Teacher

According to Martínez-Sierra et al [23],evaluation also plays an important role as teaching aiding tool, since, it helps learners track their progress. Mainly evaluation is used when learning new content. It is also used from beginning to the end, where a unit has put it as an instructional objective. Teacher should use evaluation regularly in order to provide accurate feedback to students. The study recommends allocation of enough time while evaluating the progress, just as teachers do for the overall assessment.

3.11 Competence to Assess Authenticity

Teaching and learning methods should be aimed at forming a connection between what is taught in school with real life situations. Actual learning requires student to apply their learning context to situations that are unpredictable complex and influence their theoretical knowledge. The ability for students to be able to use this in real life conditions, clearly demonstrate the level of competence they have. Being authentic is clear sign of good evaluation practices, which is highly appreciated by learners. Authentic assessment objectives are aimed at measuring students' ability in the context of reality. This is in other words, is the ability to apply content learnt, to real life situations. It majorly focuses on students' analytical skills, which includes ability to integrate context learnt in creation, writing, and speaking skills [24].

3.12 ICT Competence of Teacher to Student's Learning Outcome Assessment

In reference to Bostic et al[22] following steps should be followed while undertaking at the capacity for ICT assessment:

Step 1. Identify competencies for evaluation, such as type of knowledge; use of ICT in some of the teaching situations. Also, consider student's learning ability.

Step 2. Come up with lesson plans and quizzes in which both teachers and learners show their competencies by demonstrating their knowledge and skills in teaching for teachers, and mode of learning for students

Step 3. For evaluation to be successful, it must be purpose centered. The purpose of assessment is to be aimed at helping teachers to use the information gained in order to design and differentiate teaching and learning activities for individual students. This is because, it acknowledges students are different and approach learning in unique ways, but can be predictable in the various pathways they undertake. Therefore, it requires patience when designing

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the assessment; so as to get useful results that can be used to understand the student better, in order to effectively improve his/her learning outcomes. The information can also be used to provide necessary feedback to students to assist them improve their learning.

Step 4. Saving evaluation results helps in providing descriptive feedback to parents and teachers. In addition, students can find ways to further their studies, and teachers can adjust and develop the ICT capacity of students.

3.13 Competence to Instruct Students to Assess Themselves

Teachers should have the ability to guide students in self-assessing themselves. This is an important role since it creates self-awareness for students and motivates them. This in return, builds the self-confidence in them, and the ability to perform outstandingly in specific tasks, and work on their weakness [22].Self-assessment is quick and provides immediate feedback hence, improves learning much quicker. These also enhance academic achievements through self-reporting and using the information to enhance learning. Also, self-assessment promotes reflective skills, self-drive which increases students' self-motivation. Through self-motivation students are able to:

Come up with strategies to improve their understanding and skills

Evaluate their quality of thinking

Teachers should encourage students to adopt and practice such skills to improve their learning and self. They should be more engaged in participating in the learning process, and committed to learning outcomes. Through self-assessment, one can see that teachers also learn how to pass on these responsibilities to students.

3.14 Teachers' Competence in Using Assessment Results

According to Martínez-Sierra et al[23], using descriptive feedback is the best mode of assessing academic success. This is giving specific feedback and direction to students in order to guide them in their learning. Feedback is an integral part of the teaching process. Successfully coming up with how the students understood and handled the test, forms the link between assessment result, and what initiative should be undertaken.

Feedback should be offered immediately and give a way forward. Feedback should help the student know what needs to be done, not how true they are, or wrong. Feedback should be descriptive and specific, whereby descriptive feedback should show the relation between students' thinking, and expected learning. It provides a good example, and what steps to take for the next task, by showing clear directions for further improvement. Therefore, descriptive learning focuses on quality and effective learning.

3.15 Approaches to Building Teachers' Capacity in Classroom Assessment

The idea of job-embedded, ongoing professional development is being promoted in an increasing number of articles [25-27].and these articles emphasize that "professional development can no longer be viewed as an event that occurs on a particular day of the school year; rather, it must [25].It is believed that professional development for teachers is essential for classroom reforms that boost student accomplishment. As can be seen from the example below, high-quality professional development appears to be more and more in line with a constructivist model of teacher learning.

A study by Wilson and Sloane [28] showed the advantages of utilizing a constructivist methodology for including teachers in working on classroom evaluation (2000). These researchers investigated how middle school science teachers used a performance-based assessment-based curriculum. The new curriculum was implemented by two groups of teachers, although one group also participated in regular sessions with other instructors where the outcomes of the assessments were reviewed and debated. "The teachers in [one group] paid particular attention to the assessment method, which was the only difference in treatment between the two groups. They had a professional development program that was especially focused on the evaluation system, and they were trained to apply it [28]

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The objective is to match professional development strategies to teacher and schools needs. In this part, four approaches are discussed: (1) Teacher-led study groups or learning teams; (2) Serious Friends Teams; (3) Skilled Mentoring; and (4) unit planning content teams.

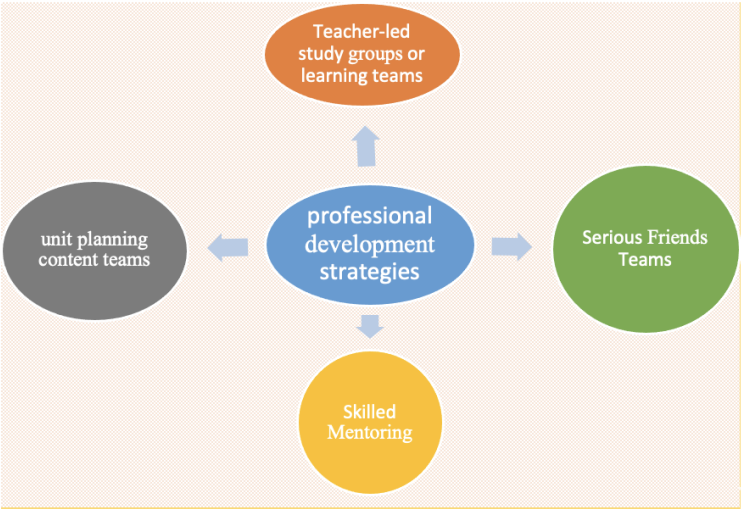

Figure 2: Professional development strategies to teacher and school's needs.

A. Teacher-Led Study Groups or Learning Teams

A learning team is described as "a collection of people who construct group goals and ideals for working and learning jointly" [29].An educational institution can address and possibly enhance the organization's capacity for change through the process of collaborative learning, structured around learning teams, by encouraging system-wide thinking and by developing methods for capturing and sharing organizational memory [30].

Learning teams are now a part of Rick Stiggins' and the Assessment Training Institute's (ATI) work to support teachers in developing their assessment strategies. ATI supports teachers in monitoring how assessment processes and findings are used formatively to support student learning as well as in assessing the quality and accuracy of assessment results. Small groups of teachers (often 3-6) who agree to manage their learning around developing their assessment literacy are used in the learning team approach to professional development. In 2003, the Nebraska Department of Education collaborated with ATI to give statewide trainings on classroom assessment that focused on the Learning Team method of evaluating literacy. The program evaluations showed that this strategy was quite effective.

B. Serious Friends Teams

Early in the 1990s, teachers became more interested in evaluations that reflected the kinds of higher-level thinking and application of subject-matter knowledge required in the "real world." The necessity for collaboratively developing performance assessments and related rubrics, as well as for reflection on the caliber of the work students created, became apparent as instructors interested in this movement implemented more alternative or performance-based assessments in their classrooms. Critical Friends Groups are a type of collaborative group meeting procedure that enables teachers to conduct continual, concentrated discussions regarding the caliber of work that students produce. In order to examine student work and its consequences for instruction, teacher teams are established and use a variety of standardized methods. In a meeting, a single teacher presents student work, and the group (the "critical friends") offers suggestions or criticisms for how the work could be improved.

The requirement for a supportive, non-judgmental environment for critical friend groups is stressed by a number of authors [31-33] , who also highlight that the best constructive criticism is "relevant, contentious, well documented, and instructional" [31]. A healthy dose of self-assurance is required for participants to implement a critical friend's group because asking someone to provide feedback on an assessment or assignment is challenging.

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Team members also need to believe they can learn from one another and have the desire to improve their work [31-33].

With a number of schools interested in starting Critical Friends Groups, SERVE has started working with them. Training adept facilitators who can oversee the group process throughout the course of a school year is the first step in putting such groups into practice. Given that many teachers find it difficult to play the role of enabling critical feedback among peers, ongoing support for these group facilitators appears to be essential. In conclusion, Critical Friends groups have the potential to be a formidable tool for evaluation and reflection on the caliber of students' thinking and work. They differ from teacher learning teams in that they follow protocols (formal group meeting agendas) created to encourage "critical" reflection and criticism for the improvement of practice and are organized around a defined goal[32].

C. Skilled Mentoring

Without an experienced "coach," it could be challenging for teachers to integrate new evaluation techniques in particular subject areas. When using the techniques they have learnt in training, teachers may need coaching and to observe a specific evaluation approach being used. A skilled coach can be a critical observer or listener who makes observations, makes questions, and provides recommendations to help other teachers deal with challenging practice-related issues [34-35] . In the past, professional coaching was more likely to employ the mentoring approach, which involved one seasoned teacher closely collaborating with one inexperienced instructor.

A fresh approach to professional coaching has just surfaced. To promote professional conversation among groups of teachers in non-evaluative, non-threatening settings, this innovative approach abandons the one-on-one mentorship structure [34]. Similar to the learning team strategy, the ultimate objective of expert coaching is to assist educational institutions in enhancing classroom practices across the board [36].While learning teams can experiment with novel assessment techniques, the quality of any group's execution may be subpar since teachers may lack necessary subject expertise or important prior experiences. When evaluation approaches are more sophisticated, a skilled coach can offer these teachers the help they need as well as modeling and feedback.

D. Teams for Unit Planning and Content

The fourth strategy for collaborating on enhancing classroom assessment starts with the premise that if teachers are to dramatically enhance their units of study, including the assessments utilized in the unit, they need much more collaborative instructional planning time. Because these are teams of qualified educators working within a specific instructional content area, providing professional development through the use of unit planning content teams respects both the idea that professional development should be situated in teacher practice and the idea that such professional development should be collaborative in nature. These teams are given organized chances to organize and carry out a well-rounded unit of study.

The four types of planning that all teachers use are the yearly, unit, weekly, and daily plans. Teachers say unit planning is the most crucial of these [37].Unit planning starts with a knowledge of your goals, your students' learning needs, the material you'll be teaching, and the teaching strategies you have at your disposal, according to Borich [38]. According to Glatthorn [39]teachers frequently construct a unit around activities. Teachers must discover links between the goals/outcomes, the material, and the assessment of individual lessons with those of the unit and the course as a whole if the unit plan is to complement the yearly plan and provide guidance to weekly and daily plans [40-44].Teachers may first require professional development in the fundamentals of unit planning, followed by time for grade level or subject teams to create their own definitions of a unit, their own methods, and their own forms for unit planning in order to achieve this [45-47].

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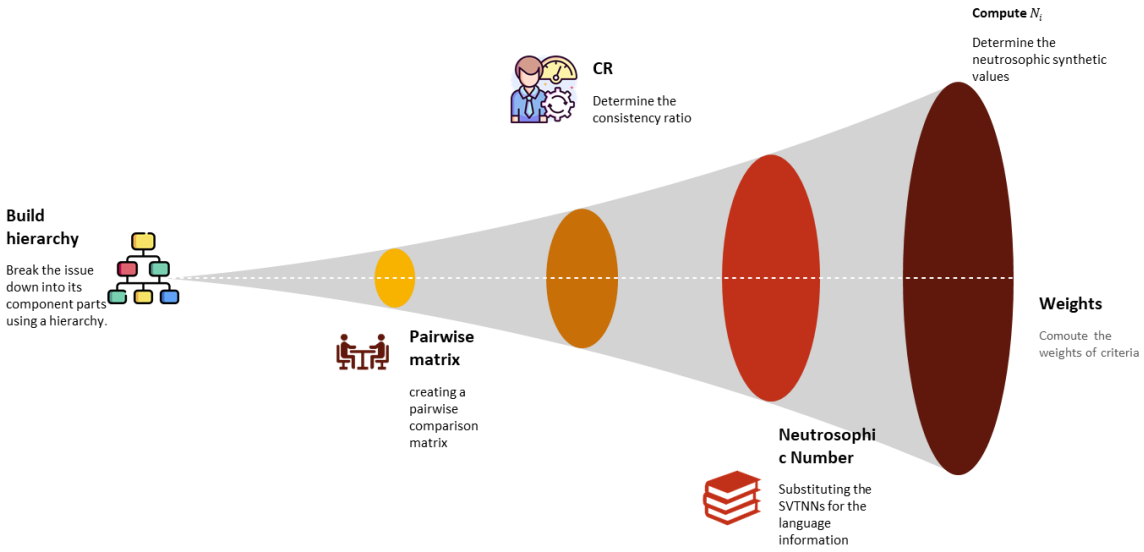

Figure 3: The steps of N-AHP.

3.16 Neutrosophic AHP Method

The research approach that was used in this investigation was a novel modification of a well-known MCDM technique (namely, the AHP), and it was carried out in an atmosphere of ambiguous neutrosophic decision-making[41]. The N-AHP methodology that has been presented incorporates both neutrosophic and AHP methodologies, with the single-valued trapezoidal neutrosophic numbers (SVTNNs) being used in the AHP computations[48-50] . Figure 3 shows the steps of the suggested method.

First, break the issue down into its parts using a hierarchy:

Establishing a hierarchy in the AHP technique that represents the aim, criteria, and options is necessary to make the issue more understandable.

Second, creating a pairwise comparison matrix involves the following steps:

The specialists evaluate the factors (also known as criteria), taking into account the degree to which each factor is important in comparison to the others.

$$A_k = [a_{ijk}] = \begin{pmatrix} 1 & \cdots & a_{1nk} \\ \vdots & \ddots & \vdots \\ \frac{1}{a_{1nk}} & \cdots & 1 \end{pmatrix} \quad (1)$$

Third, determine the consistency ratio (CR) using the following formula:

Saaty proposed using a consistency check in order to evaluate the degree to which the ratings were consistent with one another. Calculating a CR value allows for testing of both the cardinal and based on outcomes consistency in pairwise comparisons.

$$\mathrm{CR} = \frac{\frac{\lambda_{\max} - n}{n-1}}{\mathrm{RI}} \quad (2)$$

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The fourth step involves substituting the SVTNNs for the language information[44].

In line with the scale[50-54], the components in the pairwise comparison matrices are swapped out for their matching SVTNNs.

Fifth, determine the neutrosophic synthetic values using the following formula:

Calculations are done to determine every element's neutrosophic synthetic value, which is represented by the symbol N_i .

$$N_i = \sum_{j=1}^{n} \gamma_{ij} \times \left[\sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{ij}\right]^{-1} \quad (3)$$

$i = 1,2,3,4,5, \ldots . n$

Where γ_{ij} refers to the pairwise comparison element

Figuring Out the Final Weights of significance:

Calculations are made to determine the final important weights.

$$W_i = \frac{N_i}{\sum_{i=1}^{n} N_i}$$

4. Results

This section shows the results after applying the N-AHP method. Business analytics approaches like MCDM techniques are crucial decision support tools that assist organizations in making choices in complicated operational settings. The Analytic Hierarchy Process (AHP) is one of the MCDM techniques that is used the most often. This is mostly because it is simple to implement and flexible enough to be used with a wide variety of other methodologies. One of the perceived benefits of using the AHP rather than one of the other MCDA approaches is that it takes into account subjective aspects. To account for uncertainty, a significant number of research have concentrated on an extension of the AHP known as the fuzzy AHP, also known as the F-AHP. However, very few publications have studied the application of the AHP to alternative uncertainty theories, like neutrosophic sets, which have the potential to improve the capacity of the AHP to formulate a more effective decision-making process while operating in an uncertain environment. There are 13 criteria used in this study. Figure 1 shows the criteria of this paper. First, let experts assess the criteria. Table 1 shows the comparison matrix between the criteria. Then replace the linguistic terms with neutrosophic numbers. Then normalize the comparison pairwise matrix as shown in Table 2. Then compute the weights of the criteria. Figure 4 shows the weights of the criteria.

Table 1: The comparison pairwise matrix.

	EduC 1	EduC 2	EduC 3	EduC 4	EduC 5	EduC 6	EduC 7	EduC 8	EduC 9	EduC 10	EduC 11	EduC 12	Edu C_{13}
Edu C_1	1	4.66	7.15	9	7.15	4.66	6.75	9	4.66	6.75	7.15	4.66	4.66
Edu C_2	0.214592	1	9	6.75	4.66	6.75	9	6.75	4.49	1.28	6.75	6.75	9
Edu C_3	0.13986	0.111111	1	4.66	6.75	7.15	7.15	7.15	9	6.75	9	4.49	7.15

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Edu C_4	0.111 111	0.148 148	0.214 592	1	7.15	4.66	4.49	4.49	7.15	1.28	4.49	6.75	4.66
Edu C_5	0.139 86	0.214 592	0.148 148	0.139 86	1	9	9	2.78	4.66	2.78	1.28	7.15	6.75
Edu C_6	0.214 592	0.148 148	0.139 86	0.214 592	0.111 111	1	4.66	9	2.78	4.66	2.78	6.75	9
Edu C_7	0.148 148	0.111 111	0.139 86	0.222 717	0.111 111	0.214 592	1	6.75	1.28	4.49	2.78	7.15	4.49
Edu C_8	0.111 111	0.148 148	0.139 86	0.222 717	0.359 712	0.111 111	0.148 148	1	9	6.75	4.49	4.49	9
Edu C_9	0.214 592	0.222 717	0.111 111	0.139 86	0.214 592	0.359 712	0.781 25	0.111 111	1	1.28	4.66	1.28	7.15
Edu C_{10}	0.148 148	0.781 25	0.148 148	0.781 25	0.359 712	0.214 592	0.222 717	0.148 148	0.781 25	1	6.75	4.66	4.49
Edu C_{11}	0.139 86	0.148 148	0.111 111	0.222 717	0.781 25	0.359 712	0.359 712	0.222 717	0.214 592	0.148 148	1	4.49	7.15
Edu C_{12}	0.214 592	0.148 148	0.222 717	0.148 148	0.139 86	0.148 148	0.139 86	0.222 717	0.781 25	0.214 592	0.222 717	1	4.66
Edu C_{13}	0.214 592	0.111 111	0.139 86	0.214 592	0.148 148	0.111 111	0.222 717	0.111 111	0.139 86	0.222 717	0.139 86	0.214 592	1

Table 2: The normlized comparison pairwise matrix.

	EduC 1	EduC 2	EduC 3	EduC 4	EduC 5	EduC 6	EduC 7	EduC 8	EduC 9	EduC 10	EduC 11	EduC 12	EduC 13
Edu C_1	0.332 109	0.585 969	0.383 064	0.379 483	0.247 101	0.134 143	0.153 673	0.188 538	0.101 443	0.179 495	0.138 855	0.077 881	0.058 868
Edu C_2	0.071 268	0.125 745	0.482 179	0.284 613	0.161 048	0.194 306	0.204 897	0.141 403	0.097 743	0.034 038	0.131 087	0.112 811	0.113 694
Edu C_3	0.046 449	0.013 972	0.053 575	0.196 488	0.233 277	0.205 821	0.162 78	0.149 783	0.195 921	0.179 495	0.174 782	0.075 04	0.090 323
Edu C_4	0.036 901	0.018 629	0.011 497	0.042 165	0.247 101	0.134 143	0.102 221	0.094 059	0.155 648	0.034 038	0.087 197	0.112 811	0.058 868
Edu C_5	0.046 449	0.026 984	0.007 937	0.005 897	0.034 56	0.259 075	0.204 897	0.058 237	0.101 443	0.073 925	0.024 858	0.119 496	0.085 27
Edu C_6	0.071 268	0.018 629	0.007 493	0.009 048	0.003 84	0.028 786	0.106 091	0.188 538	0.060 518	0.123 918	0.053 988	0.112 811	0.113 694
Edu C_7	0.049 201	0.013 972	0.007 493	0.009 391	0.003 84	0.006 177	0.022 766	0.141 403	0.027 864	0.119 398	0.053 988	0.119 496	0.056 721
Edu C_8	0.036 901	0.018 629	0.007 493	0.009 391	0.012 432	0.003 198	0.003 373	0.020 949	0.195 921	0.179 495	0.087 197	0.075 04	0.113 694
Edu C_9	0.071 268	0.028 005	0.005 953	0.005 897	0.007 416	0.010 355	0.017 786	0.002 328	0.021 769	0.034 038	0.090 498	0.021 392	0.090 323
Edu C_{10}	0.049 201	0.098 238	0.007 937	0.032 941	0.012 432	0.006 177	0.005 07	0.003 104	0.017 007	0.026 592	0.131 087	0.077 881	0.056 721
Edu C_{11}	0.046 449	0.018 629	0.005 953	0.009 391	0.027	0.010 355	0.008 189	0.004 666	0.004 671	0.003 94	0.019 42	0.075 04	0.090 323
Edu C_{12}	0.071 268	0.018 629	0.011 932	0.006 247	0.004 834	0.004 265	0.003 184	0.004 666	0.017 007	0.005 706	0.004 325	0.016 713	0.058 868
Edu C_{13}	0.071 268	0.013 972	0.007 493	0.009 048	0.005 12	0.003 198	0.005 07	0.002 328	0.003 045	0.005 922	0.002 716	0.003 586	0.012 633

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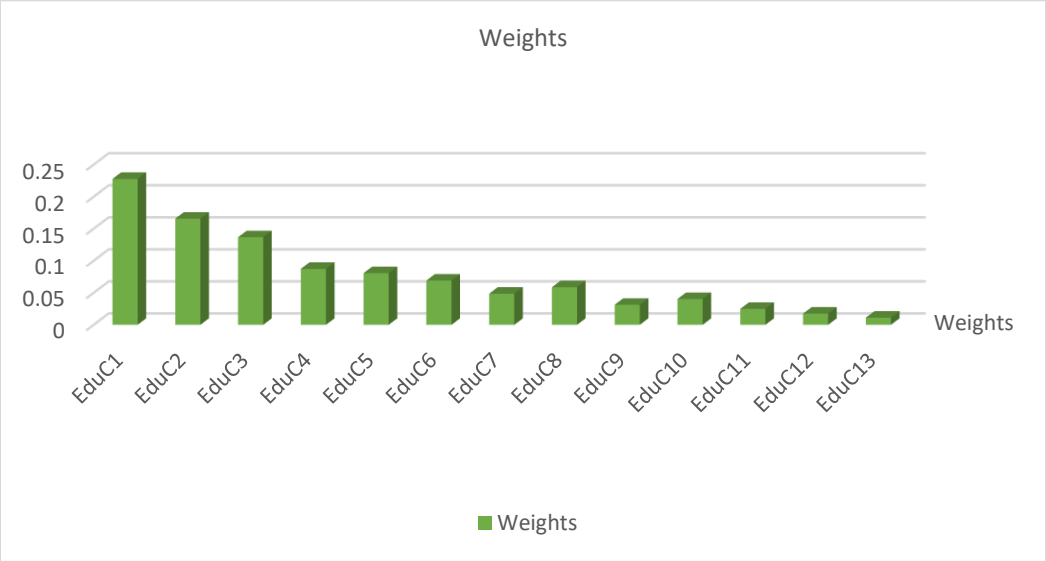

Figure 4: The weights of criteria.

5. Conclusion

United Arab Emirates education system may find it helpful to consistently enhance the breadth and caliber of support provided to teachers in the interest of enhancing classroom assessment by viewing the creation of professional development opportunities for teachers as an iterative planning cycle. The ability of schools to: Create time for cooperation; Ensure classroom application and arrange follow-up support are perhaps the most crucial factors to consider. These two actions mark a substantial shift from prevalent professional development Building Teacher Capacity practices (the one-shot workshop). They also have a direct connection to the needs that instructors taking part in professional development in the classroom report as being of the utmost importance. Assessing the development of teacher competencies helps in creating awareness for the need of capacity development. Teacher need to adopt a shift in math instructions and practices, and give chance for new development. Using various forms of assessment helps to improve learning outcomes by providing quality training and guidance to students, in order to achieve excellence in improving performance in mathematics in the UAE. In conclusion, the main result of the study understood assessment models, and teacher competency framework in the assessment of mathematics in high schools in the UAE. This study used the neutrosophic sets in the process of evaluation. The neutrosophic sets have the advantage to solve uncertain information. The neutrosophic sets integrated with the MCDM methodology. The AHP method is integrated with the AHP method to compute the weights of criteria. The experts collected to evaluate the 13 criteria in this work.

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