Mathematics excellence for middle school mathematics teachers in Wasit Governorate Mathematics teachers

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Abstract:
The current study aimed to identify the levels of mathematics excellence among the middle school mathematics teachers, and verify the study objective , as the researcher adopted the descriptive analytical approach, the study population consisted of male & female teachers of mathematics for the preparatory stage (middle school) belonging to the Wasit Education Directorate, where the size of the research sample was (152) male and female teachers By (71) male teachers and (81) female teachers who specialist in mathematics for middle school and they were distributed to the preparatory and secondary schools in the Directorate of Education in Wasit Governorate, which number is (156) schools, the researcher develop a research tool for the purpose of collecting data of the research that represented in the mathematics excellence test, it consisted of (40) items (14) items from essay type and (26) items from objective type. Statistical analysis of the test items was performed and their psychometric properties were verified , after using the appropriate statistical methods to analyze the results of applying the Mathematics Excellence test on the research sample, the results showed the following results :
1- Male and female teachers have high scores on the Mathematical Excellence Test.
2- The mathematics Excellence drives the behavior of male and female teachers towards perfecting their work, whether academic or in daily life.
3- The gender or years of service do not affect the degree of mathematics Excellence with the level of statistical significance.

Introduction:
Introduction and significant of the research:
The last period of the twenty-first century witnessed a great interest in basic and sufficient skills for success in education and life. Due to its growing importance and on a large scale, it has been identified and imposed as learning outcomes so that the learner can integrate and adapt to the changing world around him. Learning mathematics seeks to give students the real meaning of life, which rises their motivation in facing mathematical experiences that move them from the simple to the complex and from tangible to the abstract. As well as effective mathematics learning depends on the performance of the teacher and what it does to address the diverse learning styles and understand the stages of student development, and what it provides to them by using materials, tools and contexts to illustrate the meaning and interconnectedness of mathematical ideas, improve their ways of thinking, ask questions, make guesses, and provide opportunities for participation for all to enable them to explore various ways to solve problems. (Al-Gharqi, 7: 2017))

chapter One:
Identification of Research
Research problem
The teacher has a basic and main role in the success or failure of any educational system, so great attention must be paid to prepare him to have the ability and sufficiency that necessary to perform his role in delivering the message to the learner in a manner that ensures its reception and interaction with it

to proceed the required changes in learner behavior with precision and mastery in the light of scientific developments and practical applications for community& humanity service (Al-Amiri, 1: 2018)

Therefore, it is necessary to identify weaknesses in all aspects of the educational process and provide a base of rich information that is established for a process of improvement and development with clear objectives, and among these important and fundamental aspects of the educational process is the teacher, where the researcher sees through his experience in terms of his work in the field of teaching, and the educational supervision that takes upon himself the task of evaluating the performance of teachers that, the number of male & female teachers of mathematics who receive an excellent rating does not exceed 10%, as well as through the discussions conducted by the researcher across meetings and social media with some supervisors and teachers of mathematics in the education of Wasit Governorate and other governorates, from which we perceive what is consistent with our perception of the variation of mathematics teachers in terms of the breadth and depth of their mathematical knowledge

through the researcher's briefing on a number of educational research and previous studies that emphasized the importance of mathematics excellence as an necessary requirement for education in the twenty-first century for interdependence and integration between mathematics and other sciences and its life applications ,thus the formation of positive trends towards mathematic and the passion to learn and excel in it , to serve society and humanity.

Including (NCTM, 2000), (Al-Saeed, 2009), (Ubaidah, 2013), (Al-Qahtani, 2015), which raised the researcher's curiosity in research , reading , gathering information and data, analyzing and interpreting them to reach conclusions leading to the answer to the following question:

What are the levels of mathematical excellence available to middle school mathematics teachers?

The objective of the research:

The current research aims to identify the levels of mathematics excellence among the members of the research sample of middle school mathematics male & female teachers .

Hypotheses of research :

1- There is no statistically significant difference at the significance level (0.05) between the average real performance and the average hypothetical performance of male and female teachers in the mathematics excellence test.

2- There are no statistically significant differences at the level of significance (0.05) for the scores of male and female teachers of the research sample in the Mathematics Excellence Test according to years of service (10 years or less), (11-19 years), (20 years and above)

3- There are no statistically significant differences at a significance level (0.05) between the average scores of the research sample male and female teachers in the Mathematics Excellence Test (according to the gender variable)

Search terms:

1-Mathematics excellence

Theoretical definition: (Al-Saeed, 2015) defined it as: "The student's mastery of mathematical knowledge and skills and the ability to employ them in life, communication, and the production of new ideas, meaning that excellence in mathematics differs from achievement that translates mastery of mathematical knowledge and skills only." (Al-Saeed, 2015: 162)

Operational definition:

"It is the extent to which mathematics teachers in the middle school possess the skills of mathematics excellence (mathematical knowledge, higher thinking methods, mathematical sense, representations, mathematical correlations, mathematical communication, mathematical ability) that enable them to answer the items of the Mathematical Excellence test prepared for this purpose."

Second chapter :
theoretical background
First: Excellence

Responding to the requirements of global social, political and economic changes, to face the challenges and the need for economic performance, improve health, reduce poverty, anticipate more changes in

employment patterns and requirements, and the possibility of completely different new jobs emerging in an individual's work life, which requires a generation possessing the basic skills that guarantees him the success in education and life, in addition to his possession of an effective and healthy life model, through continuous focus on developing scientific culture, including arithmetic, health, and what enables him to achieve well-being. (The Scottish Governmnt, 2009: 17)

The importance of excellence:

Some studies stated that excellence achieves positive aspects in the educational process, including:

1- Building a distinguished generation with the ability to deal with the great scientific development imposed by the modern information age, and to make full advantage of the material and moral environment and its data.

2- Creating a generation that possesses the reasons for success in his life, by providing him with social and personal skills, enabling him to interact and integrate with others, giving him ability to initiate and do any good work with a clear vision of life.

3- Helping to identify skilled students in various scientific disciplines as studies have been proven that there is a clear relationship between a student's level of performance and excellence

4-Excellence can be an entry point for teaching that achieves the required mastery of knowledge, science , skills, activities and training.

5- Excellence gives students opportunities to continue learning and move on to the next stages, or work in future jobs that need highly qualified employees, and unique abilities in mathematics and science (Hill, 2009: 28-31), (Hashim, 2012: 72-73)

Second: Mathematics Excellence

Since mathematics is a rich and fertile environment to achieve excellence and creativity for learners, due to its reliance on imagination, mental perception, and logic based on correct evidence, as well as its own nature, it is experimental, practical, cumulative, deductive , and synthetic , thus it give the learners a pleasure during studying ,and its impact extends as a science in all areas of life in other scientific and natural subjects, and no branch of knowledge is devoid of the presence of mathematics, (Al-Saeed, 2010: 61).Therefore, excellence in mathematics has become a general purpose, which requires the learner to achieve the maximum possible amount of mathematical culture, health and well-being, bridge the achievement gap during the years of learning, make connections between the various scientific subjects and the applied activities of mathematics, and develop the student's ability to approximate estimation, standard sense, observation and discovery, and conduct operations Arithmetic accurately and efficiently, represent quantities, communicate in its various forms, create numerical patterns, memorize ideas and answers in different ways, And the ability in financial transactions and linking phenomena in the global environment using time, and devising new solutions to mathematical problems, and it includes measurement in its various dimensions by investigation, and his knowledge of the role of mathematics in the past and the present and what is expected of it in the future, Mathematical excellence also includes investigating and classifying shapes and objects, producing new mathematical models, using technology in learning mathematics, linking mathematical concepts, justifying choosing solutions, and mental agility. (Education Scotland, 2016: 4-7)

The role of the teacher of excellence:

One of the most important duties of a mathematics teacher for excellence is the preparation to provide good lessons to students, as the teacher is the key to successful implementation of the Excellence curriculum, through the quality of learning that is characterized by enthusiasm, challenge and enjoyment, which is reflected in the learners 'performance in showing their desire to learn mathematics and participate actively in activities and projects, Teachers must also express their belief in the objectives of the excellence curriculum in achieving the four abilities, (successful learners, confident individuals, responsible citizens, active contributors), and communicate with the community and with their colleagues and share the responsibility for the success of the school, and work in a clear framework within the national expectations. , Which is the cornerstone of building curricula for excellence and active participation through their previous experience in choosing the type of content and activities provided to learners and the way used in presenting to them. With commitment and perseverance in participating in

continuous professional development programs that support their skills and enhance their knowledge to keep pace with the scientific and educational developments that increase their enthusiasm and enable them to perform their role in producing a distinguished education that meets the learners' needs related to life and work and continuing to learn and takes into account their mental abilities. (Scottish Executive, 2006: 1-2)

Levels of Excellence in Mathematics:

Blocker and others (Plucker, et.al, 2010), identified three levels of mathematical excellence by assessing the student's ability to possess mathematical skills of varying degrees of complexity in five areas of mathematics content identified by the National Assessment of Educational Progress (NAEP) *, namely, (Characteristics of numbers and mathematical operations, measurement, geometry, data and probability analysis, algebra), and we explain the levels of mathematics excellence as follows:

1. **Basic level**: the learner's ability to understand mathematical concepts and procedures, estimation on integers, proportions, decimals, percentage, mathematical communication, simple deduction and drawing in the five mathematical fields (branches) .

2. **Proficient level:** The student applies integrated procedural knowledge, conceptual understanding, solving more complex problems, expansion and deduce by communicating with his previous experiences to induce outcomes in the five mathematical fields

3. **The advanced level**: its ability of student to apply knowledge and understanding to solve unfamiliar problems, access to meta-cognition, and its application of mathematical rules in order to generalize and synthesize concepts, and describe abstract ideas in the five fields or branches of math   . (Plucker, et.al, 2010: 5)

Maximum and minimum percentages can be specified for each level of excellence, as follows:

1- The first (**basic**) level: the student's ability to obtain a percentage (80-70%) of the Mathematical Excellence Test score

2- The second level(**Proficient**): the student's ability to obtain a percentage (90 - 80%) from the score of the Mathematical Excellence Test.

3- The third level (**advanced**): the student's ability to obtain a percentage (over 90%) of the score for the Mathematical Excellence Test.

While ,The researcher agrees with this determination of the percentages that represent the levels of mathematics excellence in calculating its availability among middle school mathematics male & female teachers through the scores they obtained in the Mathematical Excellence test prepared in the current research.

Mathematics Excellence Skills :

The researcher sees through his review of previous documents and studies on mathematics excellence skills, including (Sternbreg, 2008: 14-19) Mathematics Excellence Group, 2011: 11-14), (Al-Gharqi, 17140: 20-139), (Al-Sayed, 2018: 135-134) The presence of overlapping in some of them, and by inducing them, it was possible to identify a number of them, and after presenting them to the experts and arbitrators , the following skills were identified:

- **Mathematical knowledge**: includes (conceptual, procedural, problem solving)
- Higher thinking skills, including (originality, flexibility, fluency, interpretation, conclusion, evaluation)
- **Mathematical' sense.** It includes (numerical sense, measuring sense, statistical sense)
- **Mathematical connections** . It includes (intuitive, structural, and integrative)
- **Mathematical' communication.** It includes (reading, writing, representation)
- **Mathematical 'representation.**: it Includes (spoken language, drawings, symbols, manuals, real situations)
- **Mathematical 'ability**. It includes (numerical ability, algebraic ability, engineering ability)

Chapter Three: Research Methodology and Procedures

First / Research method:

The researcher used the descriptive and analytical method

Second: the research community

The current research community consists of female and male mathematics teachers for the preparatory stage in the General Directorate of Education in Wasit Governorate. Their number was (287) teachers (male & female) distributed into (6) directorates by (14,801) male and female students of the sixth biological and applied students.

Third: The research sample:

Because of the heterogeneity of the units of the current research community, the researcher resorted to select the sample in a random stratified method, and accordingly, a sample of (152) male & female teachers were selected, approximately (53%) of the size of the study population, distributed according to gender by (71) male teachers and (81) female teachers , and the number of students reached (5) students per one teacher, as the number of students reached (755) students,

Fourth: the search tool:

To achieve the objectives of the current research, it was required the availability of a research tool, to measure mathematics excellence among male and female teachers, thus the researcher developed a mathematics Excellence Test.

Steps of design the mathematical Excellence Exam:

1- Determine the objective of the test:

The test aims to measure the level of mathematics excellence of middle school mathematics male & female teachers.

2- Determine the test domains :

The researcher determined the areas (domains) of the test according to the skills of excellence in mathematics, as seven areas of mathematical excellence were indicated and included in the list of mathematical excellence skills prepared by the researcher and presented to the arbitrators, where   an agreement percentage (95%) was obtained from the opinions of the arbitrators, namely

1. Mathematical knowledge
2. Higher thinking skills
3. Mathematical sense
4. Mathematical Connections
5. Mathematical representations
6. Mathematical communication
7. Mathematical ability

3-Determine the number of test items and the validity of them:

The test consisted of (40) items, as the number of substantive items was (26) and the number of essay items was (14) , as they were presented to the arbitrators in methods of teaching mathematics and psychology professors, as the percentage of arbitrators agreement was more than (80%), after perform the appropriate adjustments according to the opinions of the arbitrators the test was ready to be applied .

4-Preparation of test instructions:

A-   **Answer instructions**:

Instructions for answering the test were developed, explaining how to answer the items , the number of questions, and the place designated for the answer

B-   **Correction Instructions:**

A typically answer was developed for all the test items, on which the researcher relied on correcting this test, as the total score of the test is calculated by adding the scores of the correct items . Thus, the highest score that the respondent can obtain is (110) and the lowest score is (zero) and thus the arithmetic mean of the test is (55).

5- Clarity of test instructions and items and time spent:

The time taken for the subjects to answer was calculated by calculating the average of the shortest time it took to answer the five subjects and the highest time it took to answer the five subjects. The time for answering the test was determined and reached (100) minutes, and the clarity of the test items and the answer instructions were verified.

6-Statistical analysis of the Mathematics Excellence Test items:

The test was corrected and the final score was extracted for the subjects, then the grades were arranged in descending order, and the highest (27%) of the scores were taken to represent the scores of the upper group and the lowest (27%) of the scores to represent the lower group scores.

a-Difficulty of the test items:

As the difficulty coefficient for each of the test items was calculated, it was found from the results that all the items are objective, as the paragraph difficulty factor was between (0.28-0.63) and thus all the test items are considered good and their difficulty factor is acceptable.

b-The strength of distinguishing the test items:

A paragraph (item) is acceptable if its coefficient of discrimination (Item discrimination index) is greater than (0,3) or more. (Kubiszyn & borich, 2003, P: 199), After applying the test to the pilot sample, it was found that the values of the Item discrimination index for the test items ranged between (0.33-0.67), and this indicates that the ability of the items to distinguish between the respondents to reveal individual differences between them.

c-Effectiveness of wrong alternatives :

The researcher calculated the effectiveness of the wrong alternatives, and found that it ranges between (0,111 - 0,333) and this shows that the wrong alternatives have attracted a number of the sample members in the lower group than the higher group, as negative values must be obtained for the wrong alternatives in order for the paragraph to be good (Al-Zamili and others, 2009, p. 379), and thus it was decided to keep the wrong alternatives unchanged.

d-Construction validation:

The validity of the internal consistency of the Mathematical Excellence Test was confirmed as follows:

- **The correlation coefficient of each field's score with the overall test score:**

The results indicated that the correlation coefficients of each field's score with the total score ranged between (0,473 - 0.838), which is a statistically significant all of them at the level (0.05) and the degree of freedom (98)

- **The correlation coefficient of the test items score and the overall test scores:**

Depending on the Pearson correlation coefficient, where the results showed that the correlation coefficients are all statistically significant, as they ranged between (0,23 - 0.53), which is greater when compared to the T value (0.207) at a level of significance (0.5).

- **The correlation coefficient of each item 'score to its field score :**

The Pearson correlation coefficient was extracted between the scores of the sample individuals according to each of the items of each field and their scores in that field. The correlation coefficients ranged between (0.22 - 0.87), which is greater than the T value (0,207), all of which are statistically significant at the level of significance (0.05) Degree of freedom (98)

e-Reliability of the test:

To calculate the reliability, the researcher used Cronbach Alpha formula for the test items and it was (0.91)

f- Reliability of creative problem solving test correction :

Correction reliability was found for the essay items in order to ensure the accuracy of the scores that were given to each teacher and school and to avoid random errors in two ways: (25) exam papers were drawn randomly from the survey sample papers and for the purpose of calculating the stability of correction over time. The researcher corrected the answer sheets two weeks after the first correction, and by using the Cooper equation, the results showed that the percentage of agreement between the two corrections reached (96%). The answer sheets were corrected again by a second corrector, and by using the same equation, the agreement between him and the researcher was (94%). It is a high stability coefficient

G - The final application of the tests

The researcher applied the test to the final research sample consisting of (152) male and female teachers, and their answers were examined and statistically treated.

H - statistical means :

SPSS version 21 statistical program was used for statistical data processing.

Chapter Four: Presentation and interpretation of results
The first objective : to recognize mathematical excellence among mathematics teachers:
To verify the objective of the study, the researcher analyzed the answers of the final research sample of (46) and Table No. (1) shows the teachers who obtained the score of the Mathematics Excellence test. The researcher found that the arithmetic mean of the scores of the research sample was (86,369) and a standard deviation of (7,258) and when the arithmetic mean of the research sample was measured with the hypothetical average of the test of (77) using the T-test for one sample. It appeared that the calculated T value amounted to (8.755), which is greater than the tabular value of (1.96) at the level of significance (0.05) and with a degree of freedom (119). Table No. (2) illustrates that.

Table No. (1) shows the male and female teachers who obtained the Mathematical Excellence Test Score

Variable	Variable 'level	Number of the sample
Gender	Males	24
	Females	22
Years of service	0-10 years	5
	11-19 years	23
	20 and more	18

Table No. (2) Clarifies the tabular T value of the Mathematical Excellence Test

no	Mean	Standard deviation	Hypothesis Average	Degree of freedom	T value		Significant level
					Calculated	Tabular	
46	86.369	7.258	77	45	8.775	1.96	0.05

This result indicates the high score of male and female teachers of mathematics in the Mathematical Excellence Test, which can be interpreted as the motivation for male and female teachers to excellence and obtain high degrees in order to satisfy their internal motivation and achieve the goals they seek to achieve internal satisfaction and a sense of joy of achievement.

The second objective:
Identify the significance of the differences in the mathematical excellence test of male and female teachers according to gender variables and years of service:
For the purpose of identifying the significance of the differences between the mean scores of male and female teachers in the Mathematical Excellence Test according to gender variables (males and females) and years of service, the researcher used the analysis of binary variance (ANOVA) and the results appeared in Table (3)

Table (3) Results of the analysis of binary variance (ANOVA) to reveal the significance of differences in the mathematical excellence test of male and female teachers according to gender variables. Years of service

Variation source	Set of squares	Degree of freedom	Mean of squares	P value		
Gender (males & females)	118.017	1	118.017	Calculated	Tabular	significance Level
Years of service	286.611	2	143.305	2.338		
Interaction (gender & years of service)	35.374	2	17.687	2.839	3.9	
Error percentage	2018.787	40	50.469	0.350		

Total	2370.717	45				

It is clear from Table (3) above that: 1-The significance of the difference according to the gender variable (males, females):

The difference between males and females on the mathematics excellence is not statistically significant to the level of statistical significance when we compare the calculated F value (2.338) with the tabular value (3.9) at the level of statistical significance (0.05), where the arithmetic mean of males reached (87.08) with a standrad deviation value of (6.85), while the arithmetic average of (85.59) females, with a standard deviation of (7.76) as in Table (4), this result can be explained by the fact that male and female teachers have been exposed to factors that affect their motivation towards mastering mathematics teaching and achieving mathematical excellence, and that both sexes studied the same scientific curriculum that is taught in various universities.

Table No. (4) shows the arithmetic mean and standard deviation of the sample according to the gender variable and years of service

Gender	Years of service	Mean	standard deviation	No	
Males	0-10 years	85.33	1.52	3	
	11-19 years	86.26	6.38	15	
	20- more	90.00	9.31	6	
	Total	87.08	6.85	24	
Females	0-10 years	77.50	0.70	2	
	11-19 years	83.50	6.07	8	
	20- more	88.33	8.26	12	
	Total	85.59	7.76	22	
Total	0-10 years	82.20	4.43	5	
	11-19 years	85.30	6.28	23	
	20- more	88.88	8.38	18	
	Total	86.3696	7.25828		46

2. The significance of the difference according to the service variable:

It is evident from Table (3) that the difference between males and females on the mathematical Excellence is statistically significant when we compare the calculated F value (2.839) with the tabular value of (3.9) at the level of statistical significance at (0.05), the mean is (86.36) And a standard deviation of (7.25), as in Table (4).,This result can be explained by the fact that every individual is born with several motives, and among these motives are mathematical excellence and it is considered one of the innate motives. Although experience has a role in its development, the time difference between years of service is not significant compared to male teachers or female teachers whose service is less than (5) Years for example

3-The significance of the difference according to the interaction of gender and years of service:

It is evident from Table (3) that the difference between male and female mathematics teachers and experience in mathematical distinction is not statistically significant when we compare the calculated P value (0.350) with the tabular value of (3.9) at the level of significance (0.05). Thus, gender and years of experience did not interact together in influencing the sporting excellence test, as shown in the previous table.

Recommendations:
1. Advocating for the use of the Mathematical Excellence Test by the Ministry of Education to reveal the level of performance of male and female teachers in the mathematics specialty.

2. Holding workshops and training courses for teachers on excellence in mathematics.

3. Adoption or inclusion of mathematical excellence skills within the vocabulary of the teacher's guide in intermediate and middle schools, with an indication of the steps for their implementation by subject teachers.

The proposals:

1. Study the analysis of mathematical excellence and its relationship to motivation among secondary school students.

2. The relationship of mathematical excellence to other variables such as self-efficacy, learning styles, and thinking styles.

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