Problems of teaching mathematics at the university level –

An Analytical Study

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Introduction:

The university level is one of the most important levels that determine the fate of learners, the end of the education stage, starting work, learning about ways and methods of earning, and joining jobs that enable them to live safely and face the demands of life. It also adds to the learner's opportunities for personal growth and academic learning, and it is also like any stage that a person goes through, as he faces... The student has some challenges and difficulties that put him outside his comfort zone and the routine he is accustomed to, and may create a state of confusion and psychological pressure for him. The student enters the university stage carrying many new challenges: a different kind of study, new friends, a different nature of learning, hopes, ambitions, visions, and perceptions that do not necessarily match reality, and all of this constitutes challenges and difficulties for them.

Modern trends in education have emphasized the role of the learner as the focus of the educational process and a main source for producing ideas and processing information, and employing unfamiliar ideas to generate new familiar ideas that contribute to providing successful solutions to contemporary problems, to achieve actual development in the learning process, These efforts have resulted in more effective teaching methods, more sensitive to students' needs, inclinations and trends. (Jaber, 2004, p. 19)[1]

This stage is considered a major shift in their lives, given the importance this stage holds in building the learner's personality and developing the level of thinking and culture. Despite the importance of the university stage in students' lives, they face many difficulties during it, and he shows that the problems lie In many forms, including economic, social, and personal, those related to the student or professor, and those related to the scientific subject, these challenges may result from the loss of communication with friends and classmates in the secondary stage, which the student has become accustomed to for a while. Also, the university environment is a somewhat open environment compared to the school environment, especially single-sex schools, which gives greater freedom and multiple options and attendance is Absence is at a certain rate, and the psychological factor has an important role before the student enters the university stage, At the forefront is the shock of entering the university and getting to know the university community, the way of dealing at the university, as well as the method of study, as it is completely different from

[1] The American Psychological Association's sixth edition (American Psychological ED) documentation system was used (last name, year, page), where the first digit in the reference refers to the Gregorian year, the second digit refers to page numbers, and foreign names by last name, and are arranged in the bibliography at This is the case, as for the Arabic names, they were documented in the text of the research by the last name only, and they were arranged in the complete list of references from first to last.

the stage of school education in which the student spends approximately 12 years studying, which makes him accustomed to the routine and monotonous methods of the educational and pedagogical process At that stage (Zafar, 2020, p. 16)

Therefore, countries must pay great attention to the university or academic education level, seek to develop educational curricula under the requirements of the labor market, rely on effective teaching methods, seek to modify the educational policies they follow, improve the selection of teachers, and seek to train them well to raise their efficiency and develop their abilities, and this is one of the ways To advance the intellectual and cultural level and develop the minds of students because if it succeeds in developing the minds of students, this will later help them achieve development in various economic, social and other fields

The importance of a university education is that the student chooses to specialize in the field in which he wants to work later. For example, among the students are those who want to become a doctor and join the College of Medicine, and among them are those who want to become an engineer and join the College of Engineering, and so on, and many Arab countries are interested in: Europe pays great attention to this stage, and we find that a number of these countries have made university or academic education available to their children without financial compensation or at small costs, and are keen to provide the appropriate atmosphere that contributes to graduating students capable of advancing the future of their country. They have also developed the facilities of universities, and have chosen Competent professors to give students the necessary experience. The importance of university education can be summarized in the following points:

- The youth depend fundamentally on university education to obtain a suitable job. There is no doubt that a university qualification is the basic key to entering the labor market, and thus a person is guaranteed to obtain a suitable income that helps him meet his requirements.

- Countries rely mainly on this type of education to graduate groups capable of working in various sectors and institutions, whether in health, trade, industry, tourism, or other sectors. All of this increases their progress, development, and permanently, and this education has already contributed to the graduation of doctors. Scientists, media professionals, and politicians, each of whom played a prominent role in enhancing the status of their country among other countries.

- University education plays an important role in developing cultural awareness among members of society regarding issues specific to the country, which take up a large part of the attention of public opinion. Through it, students also learn methods and etiquette of dialogue and

increase their ability to understand, think in good ways, and avoid randomness in making decisions.

Mathematics is one of the basic subjects that interest begins in the primary stage and earlier It is considered one of the basic subjects that helps students acquire multiple skills, the most important of which are mathematical thinking skills and innovative thinking skills. It also helps students acquire skills for dealing with the requirements of daily life, including Buying, traveling, and other daily skills. (Al-Desouki, 2021, p. 44)

Mathematics represents the cornerstone of the development that takes place in various areas and fields to the point that it is confirmed that it is not possible to follow the movement of diverse and accelerating scientific changes that the world is experiencing without arming itself with the minimum mathematical concepts and skills that this matter requires. Therefore, school mathematics curricula must be developed in a way that eliminates the gap. Between what students learn in educational institutions and what students learn outside them the learner realizes the extent of the benefit of learning mathematics in solving his problems and developing his abilities to make decisions regarding life situations. (Bondi, 2020, p7)

Believing in the importance of mathematics and its role in the life of the individual and society, some Arab countries have sought to pay attention to projects related to developing mathematics curricula, and one of the most important of these projects was the "Project for Developing Mathematics and Natural Sciences Curricula in the Kingdom of Saudi Arabia," as it is considered one of the pioneering educational and strategic projects that aim for comprehensive development. To teach mathematics and science, relying on the translation and harmonization of international educational materials that have proven effective in improving education. The project is based on harmonizing distinguished international series for mathematics and natural science curricula (McGraw-Hill) series for all levels of public education (Al-Ruwais, Abdel Hamid, and Al-Shalhoub, 2021, p. 87)

The National Foundation for Mathematics Education (National Research Council, 2022) also confirms that learning mathematics is a universal need that every individual needs to be an active member of his society, Mathematics embodies the efforts made by civilizations over thousands of years to understand nature and organize various human affairs, and the success of teaching mathematics depends on the competencies that the teacher possesses in the field of teaching mathematics.

The objectives of teaching mathematics at the university level are clear by achieving the following objectives:

- Improving the means of overcoming natural phenomena to harness them in the service of man.

-Working to develop students' mathematical skills

– Developing students' mathematical insight and understanding

- Working to help students use sound methods of thinking, the most prominent of which are relational thinking, critical thinking, and contemplative thinking

-Working to form sound sporting trends and develop these trends

-Teaching mathematics also aims to direct students' inclinations towards this subject

- Teaching mathematics also aims to confirm the vitality of mathematics and that it is the mother of all sciences

- Working to develop students' mental independence through the student's reliance on themselves in discovering relationships

-Increasing understanding of the aspects of civilization, and following up on scientific development and purification in society

- Preparation to study mathematical construction at the higher levels (Master's and Doctorate)

- Teaching mathematics also aims to understand the aspects of civilization and follow up on the technical and scientific development existing in society

Despite the clarity of these goals and their inclusion of all the elements that help in building the learner's personality at the university level, some problems still face teaching mathematics at the university level, and from here came the idea of the current research in searching for the most important problems of teaching mathematics at the university stage.

Feeling the problem:

The researcher sensed the problem of the current research through the following points:

First: The researcher's advice:

Through the researcher's work as a teaching assistant in the Mathematics Program, Department of Mathematics at Qatar University Note that there are some problems related to theoretical

teaching methods and strategies that are not compatible with the practical applications contained in university curricula.

Second: Results of some previous studies:

The results of some previous studies confirmed the existence of some problems in teaching mathematics at the university level, such as the study (Annan, 2022), (Abd Rabbo, 2023), (Kamal, 2023).

Research problem:

The problem of the current research was defined as presenting and analyzing the most important problems facing teaching mathematics at the university level through reviewing some scientific theses and research that dealt with teaching mathematics at the university level.

Research questions:

In light of the formulation of the research problem, the following main question was posed:

What are the problems facing teaching mathematics at the university level?

It is divided into a group of the following sub-questions:

Are these problems related to the educational content of the mathematics course at the university level?

Are these problems related to teaching methods, methods, and strategies related to teaching mathematics at the university level?

Are these problems related to the learning environment for teaching mathematics at the university level?

Research limitations: The current research was limited to:

Analysis of some dissertations and scientific research related to (teaching content - teaching methods, methods and strategies - learning environments) related to teaching mathematics at the university level in the years (2022-2023 AD)

Research Methodology:

The current research relied on the descriptive analytical approach, which is the appropriate approach for the current research, through describing and analyzing some dissertations and scientific research that dealt with (teaching content - teaching methods, methods and strategies - learning environments)

The research sample:

The research sample included (15) scientific dissertations and research to identify the results of the analysis of these dissertations, including (5) studies that dealt with teaching content, (5) studies that dealt with teaching methods, methods, and strategies, and (5) studies that dealt with mathematics learning environments.

Previous studies:

The theoretical framework included presenting a group of theses and scientific research that dealt with teaching mathematics in its various branches, and then analyzing the results of these studies and presenting a summary of the most important results reached by these studies, reviewing the most important problems that dealt with teaching mathematics at the university level: The following is a presentation of these studies according to each classification.

First: Studies that dealt with the teaching content:

- **A study (Annan, 2022)** entitled "Problems of Teaching Applied Mathematics at the University Level from the point of view of the students themselves." The study aimed to search for the problems facing teaching applied mathematics at the university level from the point of view of the students themselves. The research sample consisted of (600) male and female students. At the university level in colleges (Education specializing in mathematics - Education is basic education specializing in mathematics). The study also relied on the descriptive and analytical approach and used the questionnaire as a main tool for collecting data. The questionnaire consisted of four main dimensions, the number of questionnaire items reached (80) items, which were distributed across the four dimensions. The results of the study concluded that: Most of the problems facing the teaching of mathematics at the university level are that the teaching content is not graded, and the strategies used in teaching depend on the lecture method in general. Lack of practical application of teaching content. The results also showed that there were statistically significant differences attributed to the gender variable in favor of male students in every dimension of the questionnaire and the questionnaire as a whole.

- **A study (Taher, 2022)** entitled "Trends in Mathematics Research in Postgraduate Studies in Egyptian Universities." The study aimed to search for trends in mathematics research in postgraduate studies in Egyptian universities. The study followed a content analysis approach, and several scientific dissertations in mathematics education and certification were analyzed. from Egyptian universities, which amounted to (188) master's and doctoral theses. The researcher used a content analysis form that was prepared for this purpose. The study used frequencies,

percentages, and K2 as statistical methods to achieve the objectives of the study. The study reached a set of results, including Most of the dissertations focused on studying general education, then university education, then educational levels in basic education, and the basic education stage was the stage most covered by research studies. Most of the theses also dealt with studying the types of learners and the curriculum that is taught. Most of the theses also focused on teaching methods, especially the methods of cooperative, participatory, and electronic learning. It also showed the lack of studies and theses that dealt with statistics, measurement, and the study of numbers. The theses also focused on studying the cognitive aspects only and the lack of interest in studying the emotional and skill aspects, of the curriculum, most of the dissertations relied on studying methods for evaluating and developing curricula at different educational levels. Finally, the dissertations focused on studying the use of the computer as an educational means, and less interest in games and mathematics laboratories. The dissertations also dealt with the study of problem-solving and neglected the processes of proof, communication, interconnection, and representation.

- **A study (Abd Rabbo, 2023)** entitled "The effect of using some international models for grading standards for solving a mathematical problem in improving the performance of the solution and teaching it to student teachers specializing in mathematics." The study aimed to identify the effect of using some international models for grading standards for solving a mathematical problem in improving the performance of the solution. The student teachers specialize in mathematics. The study sample consisted of (60) mathematics teachers who graduated from colleges of education with a specialization in mathematics, The study relied on the quasi-experimental approach, and the study also relied on a "t" test to identify the significance of the differences between the experimental and control groups in the use of some international models. The results concluded that there was a statistically significant difference between the average scores of the experimental and control groups in the post-application of some international standards in favor of the Experimental group.

- **A study (Kamal, 2023)** entitled "Teaching mathematics content in colleges of education in Egyptian universities in light of the theory of numerical integration." The study relied on the descriptive and quasi-experimental approaches; the study sample consisted of (100) student teachers in colleges of education in Egyptian universities. The study relied on Parametric statistical methods in using the "t" test to identify the significance of the differences between the two experimental groups. The results concluded that there was a statistically significant difference between the experimental and control groups in the post-application due to the teaching method based on the theory of numerical integration. The results also concluded that there were no

differences. Statistically significant between males and females from the study sample in using a teaching method based on numerical integration theory.

- **A study (Mounir, 2023)** entitled "A proposed vision for developing the content of a pure mathematics course for students in colleges of education specializing in mathematics." The research aimed to: "Develop a proposed vision for developing the content of a pure mathematics course for students in colleges of education specializing in mathematics. The research relied on the descriptive analysis approach and the content analysis approach." The research relied on a content analysis form that was prepared for this purpose and included (8) main areas in the analysis process. The research was also limited to the pure mathematics course for the fourth year in the colleges of education, specializing in mathematics, The results reached: the availability of 3 areas of the content analysis form and the lack of (5) areas of the content analysis form, including: appropriate teaching strategies for the topics, lack of practical models that explain the topics, and weakness of the evaluation for each of the topics included within the course.

Second: Studies that dealt with teaching methods, methods, and strategies:

- **A study (Al-Ghamdi, 2022)** entitled "A proposed strategy to provide students who are mathematics teachers with mathematical problem-solving strategies in developing the ability to solve problems and mathematical thinking." The current research aims to develop a proposed strategy to provide students who are mathematics teachers with strategies for solving mathematical problems and developing the ability to solve problems and mathematical thinking. The research relied on the quasi-experimental approach based on an experimental design consisting of two groups, one control and the other experimental. The research sample consisted of (80) students in the fourth year majoring in mathematics at the Teachers College in Jeddah Governorate in the Kingdom of Saudi Arabia. They were divided into two groups of equal numbers, The research relied on the cognitive test and the observation card as main tools in the post-application after applying the proposed strategy, and the results proved that there was a statistically significant difference between the experimental and control groups in the post application of the problem-solving test. The results also proved that there was a statistically significant difference between the experimental and control groups in the application. Post-test of student teachers' problem-solving skills observation card.

- **A study (Badr, 2022)** entitled "The effectiveness of a proposed unit in the chart in light of the theory of multiple intelligences and its impact on students' attitudes toward mathematics." The research aimed to reveal the effectiveness of a proposed unit in the chart in light of the theory of multiple intelligences and its impact on students' attitudes toward mathematics. The research

sample consisted of (64) male and female student teachers at teachers' colleges specializing in mathematics. The research relied on the quasi-experimental approach based on designing two control and experimental groups. The research also relied on the achievement test to measure the cognitive aspect in the proposed unit based on multiple intelligences and the attitude scale to measure attitudes. Students towards mathematics, the results proved that there was a statistically significant difference between the control and experimental groups in the post-application of the achievement test in favor of the experimental group. The results also proved that there was a statistically significant difference in the post-application of the attitude scale in favor of the experimental group.

- **A study (Farouk, 2023)** entitled "A proposed strategy based on the strategies of multiple intelligences, the six hats, and K.W.L in mathematical achievement and correlation among student teachers in the Mathematics Division." The research aimed to reveal the effectiveness of a proposed strategy based on the strategies of multiple intelligences, the six hats, and K.W.L in achievement and correlation. Mathematics among student teachers in the Mathematics Division. The research sample consisted of (62) male and female student teachers in the Mathematics Division at the Teachers College, King Abdulaziz University in Jeddah, the Kingdom of Saudi Arabia. They were divided into two groups of equal numbers, one of them control and the second experimental, the research also used the quasi-experimental method, and the research relied on collecting data on the achievement test and the mathematical coherence scale. The results resulted in the presence of a statistically significant difference between the average scores of students in the experimental and control groups in the post-application of the achievement test in favor of the experimental group. The results also demonstrated the existence of a significant difference. Statistical significance between the average scores of students in the experimental and control groups in the post-application of the Mathematical Interconnection Scale in favor of the experimental group.

- **A study (Muhammad, 2023)** entitled "The effect of using the computer in training to solve mathematical problems in developing the ability of female students in the Mathematics Department at the College of Education in Mecca to solve problems and form a positive attitude towards mathematics " The research aims to reveal the effect of using the computer in training to solve problems. Mathematics in developing the ability of female students of the Mathematics Department at the College of Education in Makkah Al-Mukarramah to solve problems and form a positive attitude towards mathematics. The research relied on the descriptive and quasi-experimental approaches, it was also based on an experimental design based on one group with the use of pre- and post-applications. The research sample consisted of (35) female students

majoring in mathematics at the College of Education in Makkah Al-Mukarramah. The research used a problem-solving test prepared by the researcher, and an attitude scale prepared by the researcher. The results indicated the presence of A statistically significant difference between the pre and post-applications of the problem-solving test in favor of the post-application. The results also indicated that there was a statistically significant difference between the pre and post-applications in the attitude scale in favor of the post-application.

- **A study (Al-Aqili, 2023)** entitled "A proposed strategy based on electronic classes in teaching the mathematics course to fourth-year students in colleges of education." The research aimed to develop a proposed strategy based on electronic classes in teaching mathematics courses to fourth-year students in colleges of education. The proposed strategy included teaching Using electronic classrooms in their three forms (interactive - collaborative - integrative) and knowing their impact on the achievement of fourth-year students majoring in mathematics in colleges of education. The research relied on the quasi-experimental approach based on designing three groups, each group consisting of 35 male and female students, the study also relied on the achievement test to collect data from the study sample, and applying the strategy took an entire semester. The results of the study found that there was a statistically significant difference between the three groups in favor of the experimental group that studied using interactive electronic classes.

Third: Studies that dealt with mathematics learning environments:

- **A study (Nasser, 2022)** entitled "Developing an adaptive e-book according to the learning style (holistic/analytical) to develop the skills of solving problems of digital and logical circuits and mathematical equations and the attitude towards it among student teachers majoring in mathematics." The research aims to: develop an adaptive e-book according to the learning style (Holistic/analytical) to develop the skills of solving problems of digital and logical circuits and mathematical equations and the attitude towards it among student teachers specializing in mathematics. The research relied on the descriptive analytical method and the quasi-experimental method based on designing (3) groups, one of which is control, taught using the traditional method, and two experimental groups, one of which is taught according to the method, Holistic learning and others are taught according to the analytical learning method, The researcher also used a test for solving digital and logical circuit problems, mathematical equations, and a measure of attitude towards the e-book. The researcher relied on the use of parametric statistical methods represented by a one-way analysis of variance. The results proved that there was a statistically significant difference between the average scores of the three groups in the post-application test

for circuit problem-solving skills. Numerical, logical, and mathematical equations were in favor of the experimental group that studied using the cognitive-analytical method. The results also demonstrated that there was a statistically significant difference between the average scores of the three groups in the post-application of the measure of attitude towards the e-book in favor of the experimental group that studied according to the analytical learning method.

- **A study (Al-Mallah, 2022)** entitled "Designing a Cloud-based Smart Environment Based on a Differentiated Learning Strategy and Motivational Techniques to Develop Mathematical Understanding Skills and the level of technological acceptance among student teachers in the Mathematics Division." The research aimed to: Design a cloud-based smart environment based on a differentiated learning strategy and motivational techniques to develop skills. Mathematical understanding and the level of technological acceptance among student teachers in the Mathematics Division. The research relied on the descriptive approach and the quasi-experimental approach with a design based on the design of two groups, one of which is taught in a smart learning environment based on a differentiated learning strategy, and the other was a controlled study taught in the traditional method. The research sample consisted of (80) male and female students from the third year of the Faculty of Education, Mansoura University, specializing in mathematics. The study also relied on the use of a mathematical understanding test and a measure of technological acceptance as tools for collecting data. The results proved that there was a statistically significant difference between... The average scores of the students in the control and experimental groups in the post-application of the mathematical understanding skills test are in favor of the experimental group. The results also showed that there is a statistically significant difference between the average scores of the students in the control and experimental groups in the post-application of the technology acceptance scale in favor of the experimental group.

- **A study (Mamdouh, 2023)** entitled "The effectiveness of an electronic training environment based on micro-learning in developing graphic and engineering production skills among student teachers in colleges of education." The research aimed to: reveal the effectiveness of an electronic training environment based on micro-learning in developing graphic and engineering production skills. Among student teachers in colleges of education, the research relied on the descriptive method and the quasi-experimental method based on designing two groups, one of which is a control group taught in the traditional method and the other an experimental group taught in an electronic training learning environment based on micro-learning, The study sample consisted of (66) students from the fourth year majoring in mathematics at the Faculty of Education, Ain Shams University. They were divided into two groups of equal numbers. The

research relied on the use of a note card for the skills of producing graphs and engineering in collecting data. The results reached: There is a significant difference. Statistics between the average scores of students in the control and experimental groups in the post-application of the graphic and engineering production skills note card for the benefit of the experimental group, The results also proved the effectiveness of the electronic training learning environment based on micro-learning in developing graphic and engineering production skills

- **A study (Al-Khawaldeh, 2023)** entitled "The effect of the interaction between the timing of feedback in a personal learning environment based on augmented reality and cognitive style on achievement and motivation in the applied mathematics course among third-year students in the Applied Mathematics Division." The research aimed to reveal the effect of the interaction between the timing of feedback The study relied on the descriptive approach and the experimental approach in testing the validity of the hypotheses, The study sample consisted of (120) students from the College of Education, Amman University, Jordan, specializing in applied mathematics. They were divided into three groups of equal numbers. The research relied on the achievement test and the motivation scale to collect data. The results of the study reached: There is a statistically significant difference between the grade point averages. The students of the three groups in the post-application of the achievement test in favor of the experimental group, which was studied through the interaction between the timing of immediate feedback and the independent cognitive style, The results also proved that there was a statistically significant difference in the post-application of the motivation scale in favor of the experimental group that was studied through the interaction between the timing of the immediate feedback and the independent cognitive style. The results also proved that there was a significant effect of the interaction between the timing of the immediate feedback and the independent cognitive style in the personal learning environment.

- **A study (Al-Suhaimi, 2023)** entitled "The effectiveness of an adaptive micro-training environment based on artificial intelligence applications (expert systems - chatbots) to develop the skills of producing digital sports graphics and analyzing statistical data among female student teachers." The research aimed to reveal the effectiveness of an existing adaptive micro-training environment On applications of artificial intelligence (expert systems - chatbots) to develop the skills of producing digital mathematical graphics and analyzing statistical data among student teachers. The research sample consisted of (80) female students at the College of Education, Umm Al-Qura University in the Kingdom of Saudi Arabia, They were divided into two groups, one of which was taught in an adaptive micro-training environment based on artificial intelligence applications and expert systems, and the second group was taught in an adaptive micro-training

environment based on artificial intelligence chatbot applications. The study relied on the descriptive approach and the quasi-experimental approach to verify the validity of the hypotheses. It also relied on the study included two note cards, one of which was related to the skills of producing digital mathematical graphics, and the second card was related to analyzing statistical data. The results of the study reached the following conclusions, There was a statistically significant difference between the average scores of the students of the two groups in the post-application of the digital mathematical graphics production skills note card in favor of the experimental group that studied in the adaptive micro-training environment based on applications of artificial intelligence and expert systems. The results also revealed that there was a statistically significant difference between the average scores of Students of both groups in the post-application of the statistical data analysis.

Summary of search results:

Results related to teaching content:

- The teaching content taught in universities is not graded.

- The strategies used in teaching depend on the lecture method in general, with a lack of practical application of the teaching content.

-Lack of studies and dissertations that dealt with statistics, measurement, and the study of numbers.

-The messages focused on studying only the cognitive aspects, and there was little interest in studying the emotional and skill aspects.

Lack of reliance on international models in teaching mathematics-- Weak interest in scientific theories, especially theories related to the study of numbers.

-The lack of practical models that explain mathematical topics, and the weakness of the evaluation for each of the topics included within the mathematical curricula.

Results related to teaching methods, methods, and strategies:

-Weak interest and use of marginal teaching strategies based on e-learning and mobile learning.

-Weak interest in developing positive attitudes towards mathematics in its various branches.

- Lack of diversity in using different and modern teaching methods and relying on the lecture method in most teaching halls.

- Lack of reliance on teaching methods that develop self-learning and individual learning skills.

Findings related to learning environments:

- Lack of use of smart learning environments in teaching mathematics in its various branches.

-Although adaptive and electronic learning environments were used, they were limited to specific branches of mathematics, such as applied and pure mathematics.

-Weak interest in the professional development of in-service mathematics teachers and designing learning environments that suit their needs.

-Lack of use of training programs and training learning environments that help in achieving and acquiring some mathematical skills.

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