

The Extent of Employing Differentiated Instruction in Teaching Mathematics in Classrooms

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Abstract

The study aimed to examine the extent of employing differentiated instruction in teaching mathematics in the classroom. The study relied on the analytical descriptive approach, representing the research community of all mathematics teachers for the upper basic stage of 10 schools in Irbid, and reached the size of the study sample (40) male and female teachers, a measurement tool (questionnaire) was prepared to collect data from study members. The results of the study showed that the level of employing differentiated instruction in teaching mathematics reached a moderate level. There were no statistically significant differences in the responses of study members attributable to the following variables: (sex, school type, years of experience).

Keywords: Education, Differentiated Instruction, Mathematics, Classroom.

INTRODUCTION

Education is a vital basis for transforming an individual from a biological organism into a social one. The family, the first institution to receive him from birth, initiates this process by working to raise and develop him in accordance with society's values and customs. When he joins the school, it serves as a family support institution, completing the process of his development. Its educational curricula and various educational methods facilitate his separation from the family for a period of time during the day.

It also begins by providing him with behavioral and cognitive skills that help him develop his personality and integrate with the environment. This is done through the curriculum because it is a vital element of the educational process, as it serves as the backbone of education that reflects the culture of society, and also helps in addressing problems, discovering weaknesses of methodological organizations, and it is also a reflection of a number of mechanisms used such as: (coordination, training, and discussion) by the method that draws how to implement education and divide the subject into several classes with the identification of behavioral goals and the basis of activities and evaluation, and the element of teaching style that reflects the style adopted by the teacher to implement his method when interacting with students directly through classes (Hussein, 2017).

The rapid advancement of knowledge and technology in various areas of life has resulted in significant changes in educational policies. The primary goal of the educational process is no longer limited to the traditional learning strategies of memorizing and indoctrinating information; it is now aimed at improving the individual's intellectual skills rather than simply acquiring them. There has also been a trend towards educational, recreational, and sports activities and programmes that improve learners' mental abilities, allowing them to analyze and link the constituent elements of the educational programmed by understanding its dimensions, ensuring a teaching method capable of meeting scientific and practical requirements and needs (Hawawsa & Shibani, 2022).

Learning mathematical skills is crucial for advancing in mathematics, as students' deficiencies in certain skills hinder their progress. However, teachers must strike a balance between providing sufficient training to teach students mathematical skills and imparting concepts and generalizations. Some believe that learning mathematical skills has become unnecessary due to technological progress, as computers and calculators can perform these tasks easily and quickly. Although teaching and acquiring mathematical skills is still necessary,

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they help the learner to consciously understand, save him time and effort, and help him accomplish his life tasks (Al-Khalaf, 2021).

The teacher plays an essential part in helping learners acquire skills. A good teaching method should consider the individual differences between learners and foster positive attitudes and values. In the field of mathematics education, the teacher is the key figure in the educational process. They are responsible for possessing professional skills and competencies that enable them to effectively carry out their duties and responsibilities. They do this by utilizing all available resources, both material and human.

Experts assert that no single strategy can guarantee the intended results, and there is no universally preferred method over others. However, certain strategies and methods are more effective than others due to a variety of factors, such as the students' level, their stage of development, and the available educational resources. Choosing the appropriate teaching strategy is critical for the teaching process's success. The method should align with the students' level, respond to their preferences and abilities, consider their individual differences, and foster positive attitudes and active participation. Developing positive attitudes among students is essential for achieving positive outcomes (Hawawsa &Shibani, 2022).

Differentiated instruction is one of the modern teaching approaches that empowers teachers to meet each student's unique needs. Teachers using differentiated instruction strategically plan their teaching to meet the needs of students in the classroom and achieve the target standards, teachers who use differentiated strategies and differentiated activities apply this model in classrooms and across different grade levels (Smale et al., 2019).

At its simplest level, differentiated instruction is defined as the process of reorganizing classroom activities to provide multiple options for learners to access information, make sense of ideas, and express what they have learned. This approach addresses the process of forming ideas and developing products that enable each learner to learn effectively. It is also defined as a set of strategies that help teachers meet each student wherever he is when entering the classroom and moving him as far as possible forward in the scientific path (Lindner & Schwab, 2020). Many studies have confirmed the effectiveness of differentiated instruction in the education sector, such as (Badarin,2021; Pozas,2020; Rahma, 2017).

Based on the findings of previous studies on the importance of differentiated instruction and its vital role in the educational process, and the necessity for teachers to be familiar with its philosophy, foundations and strategies, there is a need to study the extent to which mathematics teachers employ differentiated instruction when teaching mathematics in classrooms.

Statement of the Problem

The core concept of teaching revolves around the processes of memorization and indoctrination, which are the most common methods used to impart the necessary educational content. The absence of signs of creativity, innovation, and problem-solving skills in students' education is to be expected. In the present day, it is imperative for students to possess mental abilities such as critical thinking and innovative skills in order to effectively address challenges, rather than relying only on the memorization and recall of information. The majority of conducted field studies suggest a decrease in the standard of education.

Therefore, the current study aimed to identify a teaching method that fosters effective and active learning, thereby increasing student involvement in the educational process, boosting their academic achievement, and simultaneously enhancing their skills and thinking. This study came to answer the main question: To what extent do mathematics teachers employ differentiated instruction when teaching mathematics in the classroom?

Questions of The Study

To what extent do government school teachers in Irbid Governorate employ differentiated instruction in teaching mathematics?

Are there statistically significant differences at the significance level (0.05) in the extent to which mathematics teachers employ differentiated instruction in teaching according to the gender variable?

At the significance level (0.05), are there statistically significant differences in the extent to which mathematics teachers employ differentiated instruction in teaching according to the school type variable?

Are there statistically significant differences at the significance level (0.05) in the extent to which mathematics teachers employ differentiated instruction in teaching according to the teaching experience variable?

Objectives of The Study

The aim is to determine the degree to which public school teachers in the Irbid governorate utilize differentiated instruction when teaching mathematics.

The study presents statistically significant differences, at the significance level of 0.05, in the extent to which mathematics teachers employ differentiated instruction in their teaching, based on the gender variable.

Statement of statistically significant differences at the level of significance (0.05) in the extent to which mathematics teachers employ differentiated instruction in teaching depending on the type of school.

Statement of statistically significant differences at the level of significance (0.05) in the extent to which mathematics teachers employ differentiated instruction in teaching depending on the variable of teaching experience.

Significance of The Study

The study is important since it offers a theoretical framework for comprehending the essence of differentiated instruction in relation to its concepts, foundations, and strategies. The current study aims to enhance the implementation of differentiated instruction in the mathematics curriculum, as well as other curricula, across different educational levels. This research is significant because it offers a framework, presented in a series of paragraphs, that outlines the principles and mechanisms of differentiated instruction. Educators can utilize this framework to assess the degree to which mathematics teachers employ differentiated instruction in their teaching methods.

Study Limits

Objective Limits: It was represented in stating the extent to which mathematics teachers employ differentiated instruction in teaching mathematics in the classroom.

Time Limits: The second semester of the academic year 2023/2024 AD.

Spatial Limits: Government and private schools in the Irbid District.

Human Limits: Mathematics teachers for the upper primary stage.

Terms of Study

Differentiated instruction refers to a collection of strategies that enable teachers to cater to the individual needs of each student as they enter the classroom, and guide them towards making maximum progress along their educational journey (Al-badarin, 2021).

Procedurally, the teaching portal considers the varying abilities and characteristics of students by using different teaching procedures and employing appropriate strategies to achieve specific educational goals.

LITERATURE REVIEW AND PREVIOUS STUDIES

Differentiated Instruction

Educators have differing definitions of differentiated instruction, ranging from a way of thinking about teaching and learning to an educational theory, an educational system, a teaching method, or an educational strategy. There are also many names for differentiated instruction, such as diverse education and differentiated education; all of these concepts refer to taking into account the abilities of learners and their different levels (Smale et al., 2019).

Differentiated instruction is one of the concepts that have existed since ancient times but was not practiced by teachers in the required form due to ignorance or inability to apply it in the classroom that the concept of differentiated instruction has existed since ancient times but was not practiced by teachers in the required form due to ignorance or inability to apply it in the classroom for many reasons, some writings related to education have been found by the ancient Egyptians and Greeks that call for attention to education that meets the different needs of learners and with the development of research in the field of intelligence and brain research and the increased demand for the quality of education, such a concept has emerged (Lindner & Schwab, 2020).

Differentiated instruction is defined as a strategy that seeks to raise the level of achievement of students whose abilities and potentials differ to reach a single goal. It is also defined as teaching procedures that take into account students' characteristics, abilities, inclinations, and how they prefer to learn in order to achieve a single learning outcome (Serious et al., 2020). Differentiated instruction is based on a set of principles and foundations, which include legal foundations such as human rights documents that affirm every child's right to a high-quality education commensurate with their abilities and characteristics, free from discrimination based on gender, economic or social status, or mental or physical abilities. Regarding the psychological foundations, it encompasses various methods of student learning and highlights the distinct grades of students. Additionally, it acknowledges that the human brain processes information and strives to comprehend its significance. According to the pedagogical foundations, the teacher serves as a coordinator and facilitator of the learning process, not a dictator. The learner is the primary focus of the educational process, with learning being the primary goal of teaching. The focus is on the big ideas and concepts of the learning topic, not on details that lack scientific value (Al-Khalaf, 2021).

Differentiated instruction is significant because it upholds the principle of universal education, considers various learning styles such as auditory, logical, visual, social, and sensory, caters to student inclinations and trends, thereby enhancing their motivation to learn, and establishes the necessary conditions for effective learning (Lindner & Schwab, 2020). One of the most important goals of differentiated education is to create challenging and inclusive tasks for each student, develop educational activities based on topics, concepts, and skills, provide flexible access to all content, teaching methods, and outputs, and provide opportunities for students to work according to different teaching methods. It also aims to prepare students to achieve the maximum degree of learning, taking into account their different learning styles, inclinations, and abilities. Additionally, it helps teachers provide learning for all students through different learning experiences (Smale, 2019).

Differentiated Instruction Areas

The teacher exemplifies differentiated instruction by establishing specific goals for students, both cognitive and analytical, while considering individual differences based on their mental abilities. The field of methods involves assigning students to self-learning tasks like projects, self-studies, and problem solving. Some students limit the field of outputs to their own accomplishments, while others are required to provide more comprehensive results. Differentiation in the field of evaluation can be achieved by providing different measurement methods and tools that complement each other in measuring the goals or learning outcomes to be achieved (Griful et al., 2020).

By providing the researcher with up-to-date research and scientific developments related to the study's subject, this study aims to expand existing knowledge by analyzing previous studies and comprehending current developments in this field. The results of the study showed that the teachers' possession of differentiated teaching skills came to an average degree, and there were no significant differences in the responses of the study members due to the variables of gender and experience.

Manasseh (2020) aimed to illustrate the level of active learning employment among Arabic language teachers at the higher basic stage in Kasbah Amman schools, taking into account various variables. The study was based on the descriptive-analytical curriculum. The study sample consisted of 191 teachers. The results of the study showed that the level of employment of Arabic language teachers for active education came to a high degree, and there were no significant differences due to the gender variable and years of experience.

Al-Aziz et al. (2019) sought to illustrate the level of knowledge and implementation of differentiated education and its strategies among Arabic language teachers in primary schools. The study utilised a descriptive-analytical approach. The entire research community was represented by Arabic language teachers. The study sample comprised 50 teachers. The study's findings indicated that the Arabic language teachers at the primary level had a moderate level of awareness and practice.

Barakat (2018) also aimed to show the extent of the use of active learning skills among teachers of the lower basic stage in public schools in Tulkarm governorate. The study was based on the descriptive curriculum. The study sample consisted of 232 teachers. The study's findings showed that teachers used active learning skills at a high level. It also showed that there were no statistically significant differences in the responses of study personnel due to gender, experience, specialization, or academic qualification. Given the aforementioned information, the current study aligns with previous studies by utilizing the same curriculum, specifically the descriptive analytical curriculum. However, it sets itself apart by emphasizing the extent to which mathematics teachers implement the higher basic stage of differentiated instruction in their classroom instruction.

Method and Procedures

This section explains how the researcher achieved the study's objectives. It includes a description of the study community and the sample that was chosen, as well as the tools and their validity and reliability, the statistical methods used to analyze the results and answer the questions, and the methodology used in the study.

METHODOLOGY

This study was based on the descriptive analytical method; because it is suitable for the objectives of this study, which aims to show the extent to which mathematics teachers employ differentiated instruction in teaching mathematics in the classroom.

Population and Sample

It consists of all mathematics teachers for the upper primary stage in ten government and private schools affiliated with the Education Directorate of Irbid District, and a random sample was selected representing (40) male and female teachers from the research community, and the table below shows the distribution of sample members.

Table (1) Frequencies and percentages according to study variables

Percentage	Frequency	Variable	
%35	14	Male	Gender
%65	26	Female	
%77.5	31	Government	School Type
%22.5	9	Private	
%55	22	5 years and less	Teaching Experience
%35	14	6-10 years	
%10	4	11 years and less	
%100	40	Total	

Study Tools

The researcher developed a scale for differentiated instruction, based on a number of relevant studies, to measure the extent to which mathematics teachers implement this approach in their teaching. The scale, which consisted of 20 paragraphs, also included a section for initial data collected from study participants, such as gender, school type, and teaching experience. The differentiated instruction scale maintains its truthfulness and consistency.

The Credibility of Arbitrators

The scale in its initial form was presented to a number of arbitrators to confirm the apparent honesty of the tool, numbering (9) arbitrators with specialized and experienced specialists in Jordanian universities, and they were asked to judge the quality of the content of the paragraphs and express an opinion on the linguistic

wording, its integrity and the suitability of the paragraph to the scale under which it fell in addition to any other observations, whether by deletion or addition, and the arbitrators' amendments were introduced to come up with the image of the tool in its final form, which consisted in modifying the wording of some paragraphs, and the number of the scale in its final form reached (20) paragraph.

Indicators of Reliability

After verifying the apparent accuracy of the study tool, construct validity was assessed. This reflects how well the paragraphs on the scale represent the concepts being measured. We reviewed the tool on a sample of the study population to determine the internal consistency and the contribution of each paragraph. This involved calculating the Pearson correlation coefficient between paragraphs, fields, and the overall study tool.

Correlation Coefficient	NO.	Correlation Coefficient	NO.
0.629**	11	0.656**	1
0.436**	12	0.231**	2
0.506**	13	0.451**	3
0.495**	14	0.269**	4
0.748***	15	0.201**	5
0.836**	16	0.222**	6
0.502**	17	0.265**	7
0.493**	18	0.485**	8
0.430**	19	0.347*	9
0.820**	20	0.459**	10

The table (2) shows that the correlation coefficients of the scale paragraphs range from 0.201 to 0.820. All paragraphs in the scale are accepted because their values exceed the 0.2 threshold, as recommended by Hattie (1985). Table No. 5 demonstrates the application of the internal consistency method by utilizing the Cronbach-Alpha equation to verify the reliability of the differentiated instruction scale. These values are appropriate for the study objectives.

Table

Cronbach's internal consistency coefficient, the alpha of the differentiated learning scale

Cronbach's Alpha	Domain
0.849	Differentiated Instruction Scale

The table (3) shows that the differentiated instruction scale reached a value of (0.849), which is considered educationally acceptable. Therefore, the scale is suitable for application.

Scoring Standard for the Differentiated Instruction Scale

A five-point Likert scale was adopted as follows: (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree) to indicate the extent to which mathematics teachers employ differentiated instruction in classroom teaching. The corresponding weights were (5, 4, 3, 2, 1) respectively. The arithmetic mean values were estimated according to the following categories for ease of interpreting the study results: (1.00-2.33 Low), (2.34-3.67 Medium), (3.68-5.00 High).

The Scale was Calculated According to the Following Equation:

Upper Response Limit (5) – Lower Response Limit (1)

Total sum of classes (3)

5)-1) / 3 = 1.33 and thus adding (1.33) end of classes.

The study procedures involved a thorough review of relevant theoretical literature to gain a comprehensive understanding of the subject. The descriptive analytical approach was adopted to align with the study's questions and objectives. Previous studies on the variables were utilized to develop the tools for the current study, ensuring their validity and reliability through appropriate methods. The research community and sample were identified, and books were obtained to facilitate the application of the study scale. The questionnaires were then analyzed using the SPSS system, and the necessary statistical procedures were extracted. The results were presented and discussed, leading to recommendations derived from the findings.

Statistical Processing

A set of statistical methods were applied using the Statistical Package for Social and Educational Sciences (SPSS) and are determined by the following:

Arithmetic means and standard deviations of the study individuals' responses.

Pearson's correlation coefficient to show the extent to which the paragraph belongs to the scale.

Cronbach's alpha coefficient to study the stability of the research scales.

T-test for independent samples, and ANOVA test.

Study Findings:

Findings of the first question which is: To what extent do government school teachers in Irbid Governorate employ differentiated instruction in teaching mathematics?

To answer this question, the means and standard deviations of the sections related to measuring the extend at which mathematics teachers use differentiated instruction, as table 4 clarifies:

Table 4: the means and standard deviations of the sections related to differentiated instruction

number	Section	means	Standard deviation	order	level
1	Depending on differentiated instruction strategies according to students' interests.	3.17	1.15	14	moderate
2	Using education technology in several lessons	3.47	1.15	10	moderate
3	Presenting the content in a method that fits the students' readiness and preparations.	3.32	0.97	13	moderate
4	Presenting the content in a method that fits the students' interests	4.00	0.78	4	High
5	Considering the different learning patterns when differentiation the content	3.80	1.18	7	High
6	Considering the different learning patterns when differentiation the method	3.75	1.08	8	High
7	Varying strategies used in teaching.	3.40	1.15	12	moderate
8	Encouraging the biggest number of students to participate in defining learning outcomes of the lessons	3.82	1.03	6	High
9	Developing students' collaboration skills	4.10	0.84	2	High
10	Assigning the classroom educational activities that interest students using research and investigation.	3.97	0.77	5	High
11	Balancing the individual and group activities	4.22	0.73	1	High
12	Creating a democratic learning environment during the teaching process.	3.12	1.30	15	moderate
13	Considering students' demands and desires	2.81	1.15	18	moderate
14	Making learners participate in selecting learning resources	2,87	1.15	17	Moderate

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15	Varying the selection of educational means	2.52	1.24	20	Moderate
16	Defining the weaknesses of students to address them.	4.07	0.89	3	High
17	Giving feedbacks to students' works	2.53	1.21	19	moderate
18	Helping the learner in writing his reports in an academic style.	3.05	1.22	16	moderate
19	Considering the logical order in teaching	3.42	1.03	11	moderate
20	Seeking to make the scientific topic enjoyable by adding a type of joke and aesthetical tasting of the content	3.67	1.12	9	moderate
Total score		3.42	0.73	Moderate	

Table 4 shows that the means of employing differentiated instruction by mathematics teachers is 3.42, achieving a moderate score. The means were between 4.22-2.52 ranging between moderate and high scores. Section 11 that includes "Balancing the individual and group activities in differentiated instruction" had the highest means, and section 15 that includes "Varying the selection of educational means" had the lowest means.

This result is interpreted by upper-primary school teachers' recognition of using differentiated instruction in teaching math in the classrooms as employing differentiated instruction by math teachers is considered one of the best modern directions of teaching. It is also an educational philosophy that is based on students' positive educational attitude that aims to activate the learner's role and his self-dependence in acquiring information and shaping skills, values and directions. This does not only focus on memorization and rote learning but also on developing intellectual and thinking skills as well as problem solving and teamwork.

This can be attributed to the increase of the teachers' motivation to their profession, and their coping with all the latest and modern issues in educational domain. Teachers aim to be great supportive to their students to develop their skills and raise their critical and creative thinking ability level and problem solving skills. Also, employing differentiated instruction by teachers springs from the varied educational means it can provide them in the teaching process to meet the students' different needs, and at the same time, however, taking into account differences in educational outcomes, not all students can achieve the same results and outcomes. This result was agreed with the Successor Study (2021) and the Barakat Study (2018).

Findings Of the Second Question Which Is: "Are There Statistically Significant Differences at The Significance Level (0.05) In the Extent to Which Mathematics Teachers Employ Differentiated Instruction in Teaching According to The Gender Variable?"

To answer the study question, calculation of means and standard deviations of the study scale, depending on the variable (gender), table (5) shows this:

Table (5) means and standard deviations of the study scale from the study members' perspective depending on sex variable

Standard deviation	means	Variable levels	variable
0.72	3.36	male	sex
0.75	3.46	Female	

Table 5 notes that there are apparent differences between the means measuring the extent to which mathematics teachers employ differentiated instruction in classroom mathematics, depending on the sex variable, and with a view to ascertaining the materiality of the apparent differences, T test for independent samples has been applied, as shown in table 6:

Table 6: the results of t-test independent samples according to the sex variable

Sig	df	T	variable
0.672	38	0.427	Sex

Table 6 shows that there are no statistically significant differences at the indicative level (0.05) between the means of the extent to which mathematics teachers employ differentiated instruction from the study members' perspective attributable to the sex variable. This result is due to the interest of both teachers in employing differentiated instruction in mathematics teaching, in order to make them aware of the importance of

differentiated instruction and its role in developing students' skills and improving their educational attainment. This study was in agreement with the Study of Anaemia (2020) and the Study of Barakat (2018), where they noted that there were no differences in the responses of study members attributable to the gender variable.

Findings of the third question which is: "At the significance level (0.05), are there statistically significant differences in the extent to which mathematics teachers employ differentiated instruction in teaching according to the school type variable?" To answer the study question, calculation of calculation averages and standard deviations of the study scale, depending on the variable (school type), and table (7) shows this:

Table (7) means and standard deviations of the study scale from the study members' perspective depending on the school type variable

Standard deviations		Means	Variable levels	variable
0.75		3.48	state	school type
0.67		3.22	private	

Table 7 notes that there are apparent differences between the computational averages of the measure of the extent to which mathematics teachers employ differentiated instruction in teaching mathematics in the classroom, depending on the variable type of school, and with a view to ascertaining the materiality of the apparent differences, TT's test for independent samples has been applied, as shown in table 6:

Table (8) T-Test Results for Independent Samples of Scale Depending on School Type Variable

Sig	Df	T	Variable
0.350	38	0.945	School type

Table 8 shows that there are no statistically significant differences at the indicative level (0.05) between the computational averages of the extent to which mathematics teachers employ differentiated instruction from the study members' perspective attributable to the variable type of school. This finding is explained by the fact that teachers of different workplaces have the skills associated with differentiated instruction, which indicates that the type of school does not affect teachers' attitudes.

Findings of table 4, which is: "Are there statistically significant differences at the significance level (0.05) in the extent to which mathematics teachers employ differentiated instruction in teaching according to the teaching experience variable?"

To answer the study question, calculation of the calculation averages and standard deviations of the study scale, depending on the variable (teaching experience), table (9) shows this:

Table (9) means and standard deviations of the study scale from the study members' perspective depending on the variable teaching experience

Standard deviations	Means	Variable levels	variable
0.65	3.39	5 years and less	Educational experience
0.78	3.28	6-10 years	
0.75	4.12	11 years and more	

Table 9 notes that there are apparent differences between the computational averages of the measure of the extent to which mathematics teachers employ differentiated instruction in classroom mathematics, depending on the sex variable, and in order to ascertain the materiality of the apparent differences, T test for independent samples has been applied, as shown in table 6.

Table 10: Results of "Anova one way test" according to the years of experience

Sig	F	Mean Square	DF	Sum of Squares	Variable
0.118	2.263	1.132	2	2.264	Between Groups
		0.500	37	18.511	Within Groups
			39	20.775	Total

Table 10 shows that there are no statistically significant differences at the indicative level (0.05) between the computational averages of the extent to which mathematics teachers employ differentiated instruction from the perspective of study personnel attributable to the variable years of experience. This result is that the training

courses received by less experienced and more experienced teachers are positively reflected in their ability to employ differentiated instruction. This finding was in line with the Study of Anaemia (2020) and the Study of Barakat (2018), where they noted that there were no differences in the responses of the study members attributable to the variable years of experience.

Recommendation

After drawing and discussing the findings, the study recommended the following:

Math teachers continue to employ differentiated instruction in teaching and learning process.

Acknowledge teachers and educational leaders of the importance of differentiated instruction strategies through its contributing to students' progress in learning.

Intensify teacher training to support differentiated instruction strategies.

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