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The degree to which chemistry teachers practice differentiated teaching strategy in teaching from their point of view

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Abstract - The problem of the current study was illuminated by the provision of an answer to the following question: What are chemistry teachers' perceptions of their degree of practicing the differentiated instruction strategy in teaching? The time interval of the research was the first semester of the 2020-2021 academic year, and the population was limited to chemistry teachers at high schools affiliated with Baghdad's Ministry of Education (Karkh 3rd). The instrument employed in this study was a researcher-made questionnaire comprising 20 items. One hundred chemistry teachers, consisting of 44 males and 56 females, filled out the questionnaires, and the results were extracted. The present study elucidated chemistry teachers' degree of practicing differentiated instruction in high schools. The results showed that there was not a statistically significant difference (sig. = 0.05) between male and female teachers. However, respecting the experience variable, it was found that there was a statistically significant difference (sig = 0.05) between less-experienced and experienced teachers, and this difference was for the benefit of less-experienced teachers. The author interpreted the obtained results and reached some implications; for example, enriching the university libraries with the books that are associated with differentiated instruction for more acquaintance of the academics with the importance of this strategy and holding educational workshops for teachers to familiarize them with this method, which requires teachers to consider students' needs due to individual differences among them. The author also suggests future researchers carry out similar studies to uncover chemistry teachers' degree of practicing differentiated instruction from the viewpoints of school supervisors and administers.

Keywords: teaching strategy, chemistry teachers, school supervisors and administers

I. INTRODUCTION

Chapter 1 (Statement of the Problem)

One of the major challenges ahead of teachers is the big difference in learners' levels, which governs their learning styles, surrounding, and readiness in the educational process. Thus, coaches foreground paying attention to the existing differences with numerous origins and distinctive kinds among learners. These differences are observable in different ways, including learners' differences in their wills, capabilities, and tendencies, and necessitate teachers' and coaches' provision of an education type that takes learners' diversities and differences into account.

Hence, to ensure the attainment of high-quality teaching, education experts endeavor to tailor teaching methods, strategies, and models for all learners at different levels. In the meantime, differentiated instruction is one of the most prominent strategies recently emerged for the attainment of the justice and equality principle in education. It has also rendered a kind of high-quality learning proportionate to the abilities, wills, and tendencies of all learners. Differentiated instruction is based on lesson planning wherein different educational methods are compared with contents and processes and attempts to meet several crucial factors, such as interests, learners' readiness and talents, instructional forms, and varied learning styles.

Differentiated instruction aims to assist with learners' comprehension, meaning construction, learning, and its application in various conditions. Learning is the most paramount axis of the education process, and the teacher is the coordinator and facilitator of the learning process (Kojak, 2008, p. 36-37).

Thus, the problem of the present study emerges by answering the below question:

What are chemistry teachers' perceptions of their degree of practicing the differentiated instruction strategy in teaching chemistry?

Significance of the Study

One of the philosophies of the Glory God is creating differences and distinctions among humans, such that He remarks that "Among His signs, is the creation of the skies and earth and the differences in your languages and colors; indeed, there are reminders for the wise."

Therefore, human differences reflect one of the Lord's conventions chosen for him. Human experience proves that difference is an admirable and delectable topic since it is reckoned as the source of richness and wealth. If this difference did not exist, people would resemble repeated copies with no taste and odor. This issue necessitates pursuing the concept of difference in diversity and not inconsistency, a difference that triggers richness and not a deficiency.

Therefore, students' individual differences, varying talents, and diverse indices and characteristics are the biggest challenge of the teacher when playing his role in the educational process. It is because we need a teacher who is familiar with the significance and exigency of individual differences, feel and recognize the diverse needs of students. S/he is able to adapt and coordinate himself with lesson plans, accept individual differences, and perceive them as normal characteristics of human beings (Salem, 2011).

If God observes diversity in His Quranic verses to fit them with individuals and their varying levels, it is pertaining that schools also include and observe this issue when offering lesson plans to their students. The great advancement the current era witnesses in the scientific and technology domains calls for recursion and enumeration in order to be reliable through the continuation of the information and knowledge mass that penetrates all areas of life (Al-Halit, 1994, p. 47). Education is one of these fields that is essential for encountering cognitive acceleration (cognitive explosion) and technological advancements the current era experiences. This issue makes education authorities and those intending to enhance the education efficiency undertake a great responsibility and fit teaching with the exigencies of the present (Salem, 2011, p. 3).

The application of modern teaching strategies assists with attaining active and effective outcomes in the classroom since it changes learners' behaviors and develops their abilities, making them think and innovate. It also delegates every teacher and learner a particular role to fulfill educational outcomes (Hamdaneh&Obeidat, 2012, p. 111).

The differentiated instruction concept pursues to recognize and meet these emerged challenges and exigencies noticed by many educational systems in developed countries. An education that embarks on lesson planning irrespective of learners' real competences, interests, tendencies, readiness, wills, and needs will be incapable of reaching its goals howsoever it is qualified and robust.

Reversely, teachers' knowledge of their learners' capabilities, mental characteristics, level of development and academic achievement, and scientific, economic, and social bases, as well as their awareness of the students' attitudes, tendencies, and values, make them active and lead to more effective communication and interaction skills. Moreover, this knowledge and awareness assist with the development of positive tendencies towards instructional materials (Al-Shafei, 2009, p. 95).

At present, a large body of studies and investigations has concentrated on the differentiated instruction topic; for instance, Hakemi and Al-Amarin (2015, p. 137) endeavored to evaluate the performance of elementary school teachers of Sweida province during teaching by differentiated instruction. The results of this study indicated that science teachers' degree of practicing this teaching method was insignificant and trivial.

The significance of the present study can be summarized as below:

The developments, cognitive explosion, and technological advancements the current era witnesses oblige us to prepare students to properly trust in themselves.

This research concurs with modern educational mentalities that attempt to adjust modern educational strategies towards amplifying the education process in Iraq.

Differentiated instruction can be the best approach to solving some school problems, such as the low level of students' academic achievement in the chemistry lesson. The features and advantages of the differentiated instruction that teachers exploit focus on learners as the axis of the education, as well as their participation in the teaching process, to make them take responsibility for their own learning.

Purpose of the Study

The present study aims to uncover the chemistry teachers' perceptions of their degree of practicing differentiated instruction in their teaching.

Research Questions and Hypotheses

- What are chemistry teachers' perceptions of their degree of practicing differentiated instruction in teaching chemistry?
- There is no statistically significant difference (Sig. = 0.05) between male and female teachers in their degree of practicing differentiated instruction.
- There is no statistically significant difference (Sig. = 0.05) between less-experienced and experienced teachers in their degree of practicing differentiated instruction.

Definitions of the Key Terms

Strategy

Al-Halit (2008) defines strategy as the finalization of a set of specific techniques and methods for implementing a certain skill (Al-Halit, 2008, p. 64).

Taha (2010) defines strategy as the long-term plan of teaching in different situations and is used for teaching a course or lesson unit; moreover, it is more comprehensive and inclusive than method. A strategy encompasses more than one single method to achieve long-term goals and needs time, pursuance, and experience integration (Taha, 2010, p. 40).

Differentiated Instruction

Zayer et al. (2013) define this term as an instruction that seeks to enhance the scientific level of all students, not only the students that encounter difficulties in their academic achievement. Differentiated instruction takes into account students' characteristics and their prior experiences in order to raise their potentials. The main point is teachers' expectations from students and their attention to their own competencies and potentials; i.e., providing a suitable educational atmosphere (Zayer&Akharon, 2013, p. 76).

Obeidat and AbulSamid (2014) define differentiated instruction as an education whose aim is to enhance the level of those students who face problems in their academic achievement. This is an extracurricular policy that entertains the personal characteristic and prior experiences of individuals and intends to increase students' competencies. The fundamental point in this policy is the expectation of teachers from their students and their attention to their capabilities and potentials, a policy that caters a suitable learning atmosphere for all students.

Limitations of the Study

The present study is limited to the below cases:

Temporal limitations: The first semester of the 2020-2021 academic year

Human limitations: High school chemistry teachers

Spatial limitations: High schools affiliated with Bagdad's Ministry of Education (Karkh 3rd)

Chapter 2

2.1 Differentiated Instruction

There are different perspectives on differentiated instruction since some theoreticians define differentiated instruction as a scientific extracurricular policy that considers the characteristics, experiences, and background knowledge of individuals and aims at enhancing the competence of all students, not only the ones suffering from academic achievement problems (Obeidat&Soheileh, 2007, p. 117).

However, Atiyeh (2009) defines it as an educational system whose purpose is to attain similar educational outcomes through various practices, processes, and tools. Therefore, we face multiple intelligences, which constitute a form or strategy of different teaching forms and strategies, during teaching. Concerning the above subjects, we perceive that differentiated instruction provides all students

with a suitable learning atmosphere since it is founded on different sorts of techniques, methods, actions, and tasks, enabling every student to reach his/her desired goals via proper methods, tools, and tasks.

2.2. Theoretical Frameworks of differentiated Instruction

Constructivism theory shapes the fundamentals of many modern strategies. Differentiated instruction is a strategy that primarily relies on the studies conducted on the brain. Kuisi (Al-Halisi, 2012, p. 52) explains that the teacher in a differentiated classroom categorizes the lesson in such a way that it counters the readiness level of students and thus removes the impatience and failure that may arise during the learning processes. Human brain studies prove that the brain operates by focusing on meaningful information.

Likewise, differentiated learning is based on the social constructivism theory of learning. This theory relies on what is so-called 'zone of proximal development'. Drabio calls it the difference between what the students can do by themselves and what they can do with the aid of adults. This is the same zone wherein learning takes place, and the teacher needs to understand students in order to enhance their learning abilities (Al-Halisi, 2012, p. 53). The theory also relies on intelligence studies that have given rise to important results; for example, human intelligence is multilateral and not a single unit since we learn, think, and innovate differently. We can also state that differentiated instruction has roots in the works of John Dewey, who argues that the instructor's teaching method should fit with students' needs.

Psychological Frameworks of Differentiated Instruction

1. Every student has the ability to learn.
2. Students learn in different ways.
3. Intelligence is multiple and diverse, and individuals possess different degrees of intelligence.
4. The human brain seeks to understand and acquire the meaning of the information s/he receives.
5. Learning best happens in a properly challenging and plausible situation.
6. Humans aim to achieve success, superiority, and distinction.

Educational Frameworks of Differentiated Instruction

Among the most important educational foundations of differentiated instruction, we can refer to the below cases:

1. The teacher is the coordinator and facilitator of the learning process, not a dictator executing the commands.
2. The learner is the most important axis of the teaching process, and learning is the main objective of teaching.
3. Concentration on major thoughts and concepts is more important than the excess explanations that do not build on the scientific value of the teaching process.
4. Teaching aims at assisting learners to perceive, build meaning, and convert information to the recognition they can apply in different situations.
5. Differentiated instruction does not aim at filling students' brains with discrete information that is unrelated to their lives, as well as reading out this information in exams as the sign and indication of learning.
6. A comprehensive and continuous assessment is a tool for discovering students' needs, recognizing their abilities, attitudes, and learning styles, and identifying individual differences in line with the instruction strategy that accords with these differences.
7. A classroom represents a community whose members are different; however, they live together depending on their required tasks and the convergence and divergence degree of their abilities and tendencies; moreover, they complement one another. Accordingly, teaching diversification relies on the flexibility of group works; i.e., opportunities to work in different groups, work in pairs, or work individually (Kojak, 2008, p. 37).

Hypotheses that contrive differentiated instruction:

1. Teachers' inability to render a desirable level of learning for all students by using a single teaching method
2. The lack of a single teaching method that is appropriate for all students
3. Differentiated instruction caters a different atmosphere for learning since it is based on the diversification of techniques, methods, procedures, and activities that are appropriate with different students (Atihey, 2009, p. 324).

4. Students are different in terms of their experiences, talents, interests, intelligences, languages, cultures, genders, and learning styles.
5. To ensure the maximization of every learner's potential, teachers should initially meet every student according to his/her level of readiness in every semester.
6. To ensure the maximal development of students, teachers need some student-fitted modifications more than the hypothesis that is based on coordinating students with the teaching method (Tomlinson, 1999, p. 24).

The Difference between conventional and differentiated instructions

In conventional instruction, the teacher is provided with a stimulant or goal, and s/he is in charge of implementing a unique activity to achieve similar outcomes.

Similar stimulant ——————— similar performance ——————— similar outcome

If the teacher considers individual differences and attempts to create a similar stimulant or task for all students, s/he will get varying outcomes. S/he heeds students' abilities and potentials in this condition; however, students will be incapable of reaching the same outcome since they differ in their abilities.

Similar stimulant ——————— Similar performance ——————— different outcomes concerning their levels

However, if the teacher intends to present differentiated instruction, s/he presents various stimuli and tasks to reach a similar outcome; i.e., all students are provided with a similar lesson with different methods and practices (Obeidat& Abu Al-Samidin, 2009, p. 109).

Justifications for applying differentiated instruction

As aforementioned, the factors that justify differentiated instruction are as follows (Kojak, 2008):

1. Nature of students: It is necessary to diversify teaching methods and techniques since learners do not learn similarly, and they are different in many respects and impact their intentions, abilities, learning paces, and learning priorities.
2. Human rights: What generally underscores the necessity of diversification in teaching is the effort made for implementing one of the legitimate human rights, which all international conventions have prescribed; i.e., the equal provision of a differentiated and unbiased education for all learners based on their abilities, cultures, economic levels.
3. The human brain theories and teaching methods: Teaching diversification realizes the research findings and studies associated with the human brain and learning mechanism. Multiple intelligence is one of these theories and argues that every person enjoys a set of intelligences, which are different from one person to the other in their strengths and weaknesses.
4. Goals of the educational process: Teaching diversification is a tool that can convert the learner to the axis of the educational process.
5. Educational problems: Teaching diversification assists with solving some educational problems, such as intensive academic terms, resource shortages, and the systematic problems of schools (Kojak, 2008, p. 56).

Forms of differentiated instruction

Differentiated instruction can take different forms, such as:

1. Teaching based on the multiple intelligence theory: It means the teacher presents the lesson with respect to students' preferences and multiple intelligences.
2. Teaching based on students' learning styles: Some educational psychologists categorize learner's styles into audio, visual, and motor groups. Some also add the sensory style, the instruction that applies these pseudo-teaching models, and multiple intelligences; i.e., the learner receives the instruction that fits with his/her style.
3. Participatory learning: Participatory learning is a differentiated instruction if the teacher organizes tasks and distributes them according to the students' interests and preferences (Obeidat& Abu Al-Samidan, 2009, p. 111).

Objectives of differentiated instruction

1. Development of challenging and inclusive activities for every student

2. Development of educational activities according to basic subjects, concepts, and processes, as well as significant skills
3. Development of flexible approaches for every content, instruction, and outcome
4. Providing students with opportunities to proceed according to different teaching methods
5. Applying the standards and exigencies of the lesson plan to every learner (Heacox, 2001, p. 1)

The challenges of applying differentiated instruction

The most outstanding challenges ahead of applying differentiated instruction are as follows:

1. Teacher's lack of knowledge on the book content: This type of instruction needs further knowledge for expanding and deepening the concepts.
2. The teacher lacks the classroom skills required for the differentiated instruction strategy.
3. The unfamiliarity of the teacher with the application methods of differentiated instruction
4. The classroom is not suitable, there is not enough time, or the potentials and capabilities are poor.
5. The teacher does not sufficiently believe in the significance of differentiated instruction. (Shavahin, 2014, p. 38).

Chapter 3

3.1. Methodology

To obtain the objectives of the study, the researcher relied on the descriptive-analytical method, extensively used in the areas of social, behavioral, and educational sciences. Descriptive studies have a reporting nature that does not suffice to describe phenomena. It rather goes beyond it and interprets and predicts the ultimate shape of phenomena. This method employs accurately and scientifically concentrated programs to investigate phenomena. It is recognized as a form of organized and scientific interpretation and analysis that describes a phenomenon or problem by collecting relevant data and information and paves the way for accurate analysis and investigation.

3.2. Statistical population and sample

The study population consisted of elements the researcher sought to investigate; i.e., all individuals and cases that were associated with the topic of the present study (Obeidat, 1998. P. 113). Thus, the research population comprised 100 chemistry teachers at high schools affiliated with Bagdad's Ministry of Education (Karkh 3rd).

3.3. Research instrument

The questionnaire provided in Appendix (1) was prepared as the research instrument, whose construction followed the below stages:

a) The purpose of the questionnaire: The prepared questionnaire aimed to figure out chemistry teachers' degree of practicing differentiated instruction strategy in teaching chemistry.
b) Determining the content of the questionnaire: After identifying the purpose of the questionnaire, the researcher determined its content by accessing previous studies and investigations on the differentiated instruction strategy.
c) Formulating items and expressions: Having determined its axes, the researcher prepared the questionnaire in 20 items by observing the principle of items' briefness and clarity (Appendix 1).
d) Correcting the questionnaire: In front of every item, the researcher put five levels, which indicated the degree of practicing evaluation (too high, high, average, low, too low). With respect to the Likert-scale property of the questionnaire, the teachers were given the scores of (5, 4, 3, 2, & 1), respectively, such that the lowest score was 20, and the highest was 100.
e) Validating the instrument:

Face validity of the scale: It is a measurement some experts and specialists have prescribed for the discovery of the similarity of the items with the indices to be measured (Al-Zubei, 1983, p. 155). To this end, the researcher presented the questionnaire in its initial form to a number of experts to seek their perspectives on the instrument's rate of coordination with the purpose, dimension inclusion, and clarity of expressions and their relations with the axes and consider their revisions and suggestions for improving the questionnaire.

f) Reliability of the questionnaire

To ensure the reliability of the questionnaire, the researcher employed the Cronbach alpha equation. The reliability coefficient equaled 0.82, which was relatively high and allowed the researcher to apply the instrument.

Chapter 4

Results, analysis, and discussion

1. Presenting and analyzing the results of the first purpose

To accomplish the first objective; i.e., chemistry teachers' perceptions of their degree of practicing differentiated instruction, the researcher took the below steps:

The criteria were applied to the research sample. The statistical examination of the results revealed that the calculated means of male (44) and female (56) teachers were 75.72 and 72.4, and the standard deviations were 11.01 and 10.48, respectively. To test the difference between two means (calculated mean of the sample and assumed mean of the scale), the researcher employed the T-test, which illuminated that the computed T-values equaled 9.46 and 7.85 for females and males. These magnitudes were larger than the tabular value of 1.96 when Df = 98 and Sig = 0.05. It means that there is a statistically significant difference between the assumed mean and the calculated mean of the sample members for the benefit of male and female teachers; i.e., teachers' degree of practicing differentiated instruction recorded an average score among both male and female members of the sample in teaching chemistry, as Table 1 displays.

Table 1. Significant differences between the calculated and assumed means among samples

Variable	Sample	No.	Calculated mean	SD	Assumed mean	Calculated t—value	Tabular t-value	Sig.
Evaluating teachers' degree of practicing differentiated instruction	Males	44	75.72	11.01	60	9.46	1.96	Significant
	Females	56	72.41	10.48	60	7.85	1.96	Significant

2. To fulfill the second objective; i.e., figuring out the difference among teachers' degree of practicing differentiated instruction in teaching chemistry, the researcher investigated the gender and experience variables.

- Figuring out the difference between male and female teachers in their degree of practicing differentiated instruction

The researcher employed the independent-samples *T*-test to discover if there was a significant difference between male and female chemistry teachers in their degree of practicing differentiated instruction. The calculated T-value reached 9.46, which was larger than the tabular t (1.96); when Df = 98 and Sig. = 0.05. It indicates that there is not a statistically significant difference between male and female teachers, both exhibiting similar performance in differentiated instruction since they have passed the same courses in educational centers. This issue makes chemistry teachers' degree of practicing be alike irrespective of their gender, as shown in Table 2.

Table 2. Significant differences between male and female chemistry teachers' degree of practicing differentiated instruction

Variable	Gender	No.	Calculated mean	SD	t-value		Sig.
					Calculated	Tabular	
Evaluating chemistry teachers' degree of practicing differentiated instruction	Male	44	75.72	11.01	9.46	1.96	Not significant
	Female	56	72.41	10.48			

Df = 98; Sig = 0.05

- Figuring out the difference between experienced and less-experienced chemistry teachers' degree of practicing differentiated instruction

The researcher employed the independent-samples T-test to discover the differences among chemistry teachers' degree of practicing differentiated instruction with respect to their teaching experiences (5-10 years and >10 years). The calculated T value equaled 4.55, which was larger than the tabular t (1.96); when Df = 98 and Sig. = 0.05. This indicates that there is a statistically significant difference for the benefit of the teachers with 5-10 years of experience. It means that less-experienced teachers (5-10 years) practice differentiated instruction more since educational and teacher preparation programs have been focused on more than ever. Experienced teachers consider that modern methods of teaching waste time, solely pay attention to the scientific content, and neglect students and their individual differences, as shown in Table 3.

Table 3. Differences between experienced and less-experienced chemistry teachers' degree of practicing differentiated instruction

Variable	**Experience**	**No.**	**Calculated mean**	**SD**	**T value**		**Sig.**
					Calculated	Tabular	
Evaluating chemistry teachers' degree of practicing differentiated instruction	5-10 years	62	74.87	10.65	4.55	1.96	Significant
	>10 years	38	72.28	11.02			

Df = 98; Sig = 0.05

Chapter 5

Implications of the study

With respect to the results of the study, the following implications arise:

1. Convincing teachers to employ modern strategies, like differentiated instruction, in teaching and not suffice to conventional methods. However, recent educational studies have proved the effect of modern methods on enhancing the academic achievement level of students.
2. Enriching university libraries with the books that are related to differentiated instruction to familiarize teachers with the importance of this strategy
3. Holding educational workshops for teachers to familiarize them with this method, which requires teachers to consider students' needs due to individual differences among them
4. Holding in-service workshops for teachers to prepare them to employ modern technologies in their teaching

II. SUGGESTIONS

To complement the present study, the researcher suggests future researchers replicate this study to uncover and evaluate chemistry teachers' degree of practicing differentiated instruction from the viewpoints of school supervisors and administers.

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