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THE STATUS OF THE INDUCTIVE METHOD IN EDUCATION AND ITS IMPACT ON ACADEMIC ACHIEVEMENT: A COMPARATIVE STUDY BETWEEN ARABIC LANGUAGE AND SCIENCE EDUCATION

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ABSTRACT

This research aims to enhance teachers' pedagogical practices and improve their professional performance. To achieve this objective, the researcher employed multiple methods, particularly descriptive and comparative approaches, combining a survey study with a practical field study. The sample consisted of 20 teachers out of 100 and 24 students out of 500. Data were analyzed using statistical variance methods to examine the relationship between academic achievement and the effectiveness of teaching methods.
The findings indicate that teaching Arabic grammar and science education both rely on the inductive method. The use of induction was found to account for 14.89% - a statistically significant result, as it exceeds the critical values of 4.05 and 7.21 at the 5% and 1% confidence levels, respectively. Despite differences in subject matter and methodological approaches, both disciplines utilize induction - systematic induction in the case of Arabic grammar, and experimental induction in the case of scientific education - each tailored to the nature of the subject.

KEYWORDS

Method, Induction, Education, Science Education, Academic Achievement, Arabic Language

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1. Introduction

Teaching methods are a mechanism for presenting and implementing educational curricula and achieving established educational objectives. Hence, the method changes with changes in programs and objectives, given that the nature of the subject matter determines the appropriate method.

A distinction must be made between mastery of the scientific material and the ability to teach it, given that mastery of the material alone is not sufficient to achieve and ensure teaching competence. We often find individuals with high cultures, abundant knowledge, and a wealth of information lacking the ability to express this knowledge and, consequently, unable to communicate it effectively to others. The secret to this lies in the fact that teaching is an art before it is a science. While mastery of the subject matter and teaching skill are two complementary poles that cannot be practically separated, we believe that teaching methods, strategies, and approaches are the cornerstone of the educational process, as the success of education and the achievement of desired educational goals depend on them. This does not mean that methods should become rigid templates; rather, they should be flexible. Each subject has its own method, based on its nature. This does not negate the existence of a group of subjects that share a

common method. Furthermore, each teacher has their own method, or rather their own style, generally represented by the techniques and technologies they employ in their teaching.

2. Theoretical framework of the study:

2.1. The Problem of the Study:

Educators have always attached great importance to the subject of teaching methods, and they continually strive to develop them to raise the level of educational performance. Despite the efforts made by psychologists and educators in this direction, many teachers and supervisors remain ignorant of many of these methods, or they do not utilize them properly, or at least lack an academic background. This is despite the experience they possess, gained through field practice, and based on intuition rather than insight. Hence, the problem of knowledge and action, and the approach to thought and experience, arises. Given that any science must be based on two fundamental pillars: the first is knowledge, and the second is method, i.e., curriculum.

Given that familiarity with scientific knowledge and mastery of the subject matter are essential and necessary conditions for entry into the education sector, this is reflected in the academic degree held by the candidate in question, which should, in principle, qualify them to work in this sector. However, does the candidate's acquisition and possession of this certificate truly qualify them to undertake the mission of educating and training the younger generations in accordance with the desired educational goals? This is especially true given that many professors, even researchers and authors, are confused by the concepts of (induction, deduction, conclusion, analogy, etc.).

This is what this research will address.

Based on this, the research problem can be presented through the set of questions it raises, which we present as follows:

2.2. Questions:

- What is the impact of using the inductive method in teaching on academic achievement in the Arabic language?
- What is the impact of using the inductive method in teaching on academic achievement in science education?
- Does the use of the inductive method in teaching differ on academic achievement in Arabic grammar from its use in teaching science education?

2.3. Proposing Hypotheses:

In light of the previous questions of the problem, the following hypotheses can be proposed:

- The use of the inductive method in teaching affects academic achievement in the Arabic language.
- The use of the inductive method in teaching affects academic achievement in science education.
- The use of the inductive method in teaching Arabic grammar differs methodologically from its use in teaching science education.

2.4. Research Objectives:

Based on the reasons mentioned above (reasons for choosing the topic), which served as a motivating factor, the researchers chose and conducted this research. This research is based on its importance, in their estimation, and its contribution to solving this problem by shedding light on its various dimensions. This research aims to advance teachers' pedagogical practice, develop their professional performance, improve the quality of their teaching, and achieve a quality that positively impacts students' academic achievement.

2.5. Research Importance :

The focus of this study revolves around teaching methodology, given that teaching methods are considered (in the researchers' estimation) the cornerstone of the educational process and one of the essential components of the educational curriculum. This is because mastery of the scientific material alone is not sufficient to achieve educational competence. Rather, it is essential to know the various teaching methods and their proper use in the field of education.

2.6. Research Methodology and Tools:

The researchers adopted a descriptive approach supported by critical analysis in the theoretical section.

In the applied section, they adopted a comparative approach between the exploratory study (inspection reports) and the primary study.

The researchers also used an evaluation grid (represented by an achievement test), guided by the test construction guide approved by the Ministry of National Education in 2018, and an observation grid (in the form of a teacher's visit card, represented by inspection reports) as research tools. These tools were designed by a group of experienced inspectors (experts) based on their experience, in light of the outcomes of state, regional, and national forums and an in-depth study. This justifies the validity and reliability of the test tool, given that its cognitive content is derived from the established curriculum. Furthermore, it has been tested and applied several times, yielding similar results.

He compared them using a statistical method represented by analysis of variance, to highlight the difference between the two variables: academic background represented by familiarity with the subject matter (academic achievement as a dependent variable), and educational experience represented by an effective teaching method (as an independent variable).

2.7. Research Sample:

The study included a group of teachers and a group of students in the eight schools in the seventeenth district, supervised by the researcher as an inspector (educational supervisor) in primary education. These schools are located in the city of Batna, distributed across upscale (urban) and working-class (semi-urban) neighborhoods.

Their number is estimated at approximately 100 teachers, including both males and females, representing the original population. A representative sample was intentionally drawn from this sample (fifth-year teachers), estimated at 2 teachers, 24 Arabic language students, and 40 science students, unintentionally (using odd numbers in the first and even numbers according to random probability tables). This sample included both males and females.

This was done to ensure the reliability of the test, which was administered to the sample members using a repetition mechanism during the 2021/2022 academic year.

2.8. Defining Terms:

Scientific studies, for methodological considerations, require, like any new term included in a research title, a procedural definition:

2.8.1. Method:

The general stages followed by teachers in their teaching to achieve a specific goal, with the intent of conveying information and knowledge to students. Procedurally, it is a set of procedures and means adopted by the teacher and learner to enable the learner to master the lesson as a whole. And to enable them to acquire the required (targeted) skills and behaviors.

2.8.2. Induction:

It is the method or approach followed by human thinking based on concrete examples (such as individual cases) to arrive at abstract general laws, progressing from the specific to the general. Procedurally, it is a process of research and investigation that progresses from the concrete to the abstract.

2.8.3. Education (teaching):

An interactive process between the teacher and the learner, whereby the learner is empowered with the targeted knowledge, skills, and behaviors (attitudes). Procedurally, it is the teacher's activity in interacting with the learner to enable them to learn.

2.8.4. Academic achievement:

The sum of knowledge, skills, and behaviors acquired by learners through the teaching and learning process. Procedurally, it is the difference between the inputs (activities and procedures) and the outputs (results) of the lesson.

2.9. Previous Studies (lierature review):

By reviewing the educational research database, the researcher found a group of studies relevant to the topic under investigation, namely:

2.9.1. The Effect of the Standard and Inductive Method in Teaching Arabic Grammar in the Second Year of Middle School : (Ben Zish, Maryam, 2017)

The researcher conducted her study on a sample of 31 teachers (M, I) and 30 students (M, I) from an original community consisting of (M, I) in four middle schools in the city of Guelma during 2017.

She adopted the descriptive analytical approach and the comparative method, using observation and a questionnaire (11 questions) conducted at middle schools in the city of Guelma to collect information and process it statistically using the percentage method.

The study concluded that the inductive method (73.30%) was more appropriate for teaching Arabic grammar than the standard method (26.67%).

The student questionnaire, which included seven questions, addressed the ease (40%) and difficulty (60%) of understanding Arabic grammar.

Comment: The researcher used the questionnaire, which is a weak tool, and did not apply an achievement test to the students to measure the difference between the two methods (standard and inductive).

2.9.2. The Effect of Using the Inductive Method on Academic Achievement in Science among Fifth Grade Students : (Asri, Ali Al-Ramamneh, et al., 2016):

The researchers conducted their study on a sample of 88 students (male and female) from a community of 815 (male and female) in schools in Balqa Governorate, Jordan, during the 2012/2013 academic year.

Using the experimental approach, the sample was randomly divided into two equal groups: a control group (44 students) and an experimental group (44 students). The students were taught using two different methods (conventional and inductive), respectively. A 40-item achievement test was used to collect and statistically process information using the variance method. They concluded that there were significant differences in favor of the inductive method, estimated at 0.72.

Comment: The study confirmed the superiority of the inductive method over the conventional method, but did not specify the nature of the latter's approach, merely indicating that it relied solely on memorization.

2.9.3. Teachers' Teaching Methods and Their Relationship to Academic Achievement (in Middle School) : (Ben Atrio, Manal 2020):

The researcher conducted her study on a sample of 41 teachers (male, female) from an indigenous community of (male, female) at the Colonel Amirouche Middle School in the municipality of El Maleh, M'Sila Province, during the 2019/2020 academic year.

The researcher adopted a descriptive approach and used a questionnaire (33 questions) to collect information and process it statistically using the percentage method.

The researcher concluded that teaching method plays a role in academic achievement (without specifying its percentage?...).

Comment: The researcher only indicated the role of the teacher's teaching method on academic achievement, without specifying its impact by a specific percentage.

(Damash, Shaima, 2017): Teaching Methods and Their Relationship to Classroom Interaction among Middle School Students in the Municipality of M'Sila

The researcher conducted her study on a sample of 125 teachers (male and female) from an original community that included 25 middle schools (male and female) in the municipality of M'Sila during the 2016/2017 academic year.

She adopted a descriptive approach and utilized observation and a questionnaire (34 questions) to collect information and process it statistically using the chi-square method.

She concluded that 75.60% of teachers stimulate students' motivation to solve problems, with a chi-square value of 16.36, which is significant.

Comment: The study focused on the role of teaching methods in general in classroom interaction, without specifying a specific method or linking it to academic achievement.

2.9.4. The relationship between learning strategies and motivation and their impact on academic achievement : (Ben Youssef, Amal, 2008):

The researcher conducted her study on a sample of 150 students (male and female) from an original community of 610 students (male and female) in several secondary schools in Blida during the 2006/2007 academic year.

She adopted a descriptive approach and utilized the Motivation Scale and Learning Strategies Scale tools to collect and statistically process information using the correlation coefficient method to determine the relationship between two variables.

She concluded that there is a correlation between motivation, the strategy used, and academic achievement, estimated at (0.80).

Comment: The study examined the relationship between learning strategies in general and motivation and their impact on academic achievement, without linking them to a specific teaching method.

2.9.5. The Relationship Between Learning Strategies and Academic Achievement among Male and Female Students of the Faculty of Educational Sciences at Al-Isra Private University : (Al-Masry, Muhammad, 2005)

The researcher conducted his study on a purposive sample of 85 students (male, female) from an original community of 388 students (male, female) at the Faculty of Educational Sciences at Al-Isra Private University during the 2004/2005 academic year.

He adopted a descriptive approach and used a questionnaire to collect information and process it statistically using the correlation coefficient method.

He concluded that there was a significant positive correlation between learning strategies and academic achievement, estimated at (0.92).

Comment: The study was limited to the role of learning strategies in academic achievement, without specifying a specific teaching method such as induction and deduction.

2.9.6. The extent of the impact of teacher experience on the academic achievement of primary school students : (Boukhamala, Shaima, 2014)

The researcher conducted her study on a random sample of 35 teachers (male, female) from an original community that included a group of school teachers located in the provinces of Tebessa and Oum El Bouaghi. (M.D., E.) during the academic year 2013/2014.

The study adopted a descriptive approach and utilized a questionnaire to collect and statistically process information using the percentage method. The study concluded that the general hypothesis was confirmed through the two partial hypotheses, namely that teacher experience has an impact on students' academic achievement.

Comment: The study examined the extent to which all components of teacher experience impact academic achievement, without focusing on teaching methods.

2.9.7. Obstacles to the Implementation of the Modern Teaching Strategies Project from the Perspective of Primary School Teachers : (Baabsha, Manal, 2014)

The researcher conducted her study on a sample of 120 teachers (M, I) from an original community that included a group of teachers from Oum El Bouaghi schools (M, I), during the 2013/2014 academic year.

The study adopted a descriptive approach and utilized a questionnaire to collect and statistically process information using the percentage method.

The study concluded that teachers face difficulties in implementing the Modern Teaching Strategies Project, particularly administrative, training, and preparatory aspects.

Comment: This study did not link modern teaching strategies, such as mechanisms and techniques, to academic achievement as a product of learning.

General Comment:

Given the shortcomings recorded in previous studies, most of which addressed the relationship between learning strategies (such as specific techniques and methods) or teaching methods (in general) and academic achievement without specifying a specific method, such as induction, and comparing it to the method of measurement or deduction, this is with the exception of the studies by Al-Ramamanah (in science), who did not specify a method for what he called the conventional method. And Ben Zeish (in Arabic), who compared

the method of measurement to induction, they were satisfied with a questionnaire only, without conducting an achievement test to measure this effect. Furthermore, we did not find a comparative study between the method of measurement and induction in both the sciences and the Arabic language, particularly in primary education.

Therefore, the researchers undertook this research to address this deficiency, in an effort to provide new added value to this field.

3. Induction

3.1. The Concept of Induction

A- The Linguistic Meaning of the Word Induction:

By consulting linguistic dictionaries and referring to sources, we find that the word "induction," as a verbal noun, is derived from the augmented verb (istqrā) with three letters (alif, sin, and ta'). Its original (bare) verb is (qara) or (qara), not qara'a. Both (the first and second) end with a maqsura alif, which is the correct form, or more precisely, (qara), which is more correct. Thus, one says "qara qarwa," meaning to follow and examine it. The matter is read, and "istqrā ash-shay" means to follow its details. The Arabic word "istqrā" is equivalent to "induction" in French and English. The Greek word "epagogy" (Aristotle) means "leading" (Hamdi, 2016, p. 13).

It is derived from the words "enay wyn," meaning "to lead" (Buhush and Al-Dhanibat, 1999: 174). It denotes the movement of thought leading to a process that leads to a specific result. Contrary to references that draw (prove) it with a hamza, (istaqra'a) is incorrect, because its meaning is to request reading, as opposed to iqra', which means to make the (student) read. This is analogous to the word (masdar) istiqsā', which is done by the verb istiqsā. It is incorrect to say istiqsā' with a hamza, which is incorrect. This is regarding the etymological root of the verb. As for its linguistic meaning, (istiqra) means to follow, which is similar to istiqsā, meaning to follow its trace to its distant extent, because its comparative name, 'aqsa', means the furthest.

Induction, then, indicates the tracking and pursuit of a specific thing or phenomenon, starting from its beginning to its end, with the aim of investigating its conditions, discovering its truth, and determining its nature through continuous research and investigation.

B- The technical meaning of induction:

If we were to define the word induction, it would mean, in its simplest sense, a progression from part to whole, or more accurately, a transition from the particular to the general.

Because the process goes beyond simply combining and linking elements together as scattered parts or fragments to obtain something (product) represented by a composite whole as a mechanical procedure (as opposed to deconstruction, which is based on analysis).

In fact, induction, as an intellectual method aimed at acquiring knowledge, is based on the method of integration and synthesis to obtain a conclusion (product) characterized by novelty and innovation in the form of an original creative synthesis or composition. This refers to the combination of harmonious, similar, and consensual elements (reconciling) to achieve and create a kind of harmony between them, in contrast to the eclectic tendency, which is merely a combination of different, or rather disparate, elements, leading to dissonance and contradiction rather than harmony and coherence. In this sense, induction denotes the transition from a judgment of the particular to a judgment of the general, considering the starting point and the point of arrival. In other words, in the concept of the reverse, it is a judgment of the general based on the judgment of the particular, in the form of an ascending process from the simplest to the most complex. This process denotes the judgment of the establishment of a characteristic or property for a number of individuals, leading to the judgment of the establishment of this characteristic for all things shared by them, by way of generalization or exhaustiveness, in accordance with the principle of similarity or analogy, which assumes consistency in phenomena. From the above, we can arrive at a comprehensive definition of induction, stating that it is a mental process by which the mind determines the establishment of a judgment on a group (sample) of individual elements, leading to the issuance of a general, comprehensive judgment on all cases that fall under the concept of its type (Yaqoubi, 1979, p.185). It involves deriving a general, abstract conclusion (in the form of a rule, theory, or law) from specific, sensory data in the form of systematic induction (Boukli Hassan et al., 2008: 86), i.e., based on theoretical rational arguments, as is the case in Arabic grammar, based on examples. Or, it is a material, sensory induction based on the experimental method, which relies on observation and experimentation, as is the case for deducing a law in science education.

3.2. The Problem of Induction

3.2.1. The Basis of Induction

Experimental sciences are based on induction. After observing the phenomenon as a whole as a first step (in accordance with the Gestalt principle, which states that the whole precedes its parts), researchers adopt a (partial) hypothesis, considered most plausible by the researcher, from a set of possible hypotheses. They then subject this hypothesis to experimentation (as a technical procedure) to derive a conclusion in the form of a theory or general rule.

This means that the researcher begins with the method of analysis and moves to the method of synthesis (imposing a law). This is the very essence of induction. They then generalize this law (result) to partial cases similar to the first cases adopted. Therefore, it has been said that scientific knowledge (the discovery of truth) is an analysis (part) between two (whole) structures. However, the first whole is merely an input sensory perception, while the second whole is also theoretical and functional. Note that there is a difference between the mere word "part" and the word "partial" (in the sense of "particular"). A part does not necessarily have to be particular. Similarly, a distinction must be made between the word "whole" (in the sense of a complete whole composed of multiple elements) and the word "universal" (in the sense of a general) in the form of an abstract principle or rule. The whole does not necessarily have to be an expression or representation of the abstract principle or rule (Ibrahim,2016).

This is why induction is a more appropriate method for lower levels (because it is based on the tangible).

Deduction, as a method, is more appropriate for higher levels (because it relies on abstract rational reasoning), but in practice, the two are complementary (Haddad and Salama Adam, 1977, pp. 81-83).

3.2.2. The Relationship of Induction to Relativity and Determinism

Induction is based on two fundamental principles: causality and determinism. The principle of causality states that every effect has a cause; everything has a reason, and nothing in nature arises from nothing. Results are dependent on and linked to preceding causes. Through the principle of causality, the mind keeps pace with the movement of reality and tracks its steady progression. Events do not occur randomly, but rather are subject to strict, precise, and precise laws that never fail to reveal the secrets of phenomena.

- The principle of determinism:

The gist of which is that the same conditions (causes) lead to the same results. It is a principle that complements the principle of causality, except that it goes in the opposite direction of the first, noting that scientific determinism is not coercive (philosophical). If the principle of causality starts from the result to search (recover) for the reason behind the occurrence of the phenomenon procedurally, not logically, because the cause in truth and reality precedes the existence of the result, with the aim of verifying the validity of the hypothesis, in accordance with the principle of coupling between the influencer and the effect, the principle of determinism, on the contrary, starts from the cause to predict the occurrence of the result in advance, in accordance with the principle of regularity (repetition of similar incidents and the stability of their occurrence), based on and depending on previous experiences (Reichenbach, 1959 p.76).

3.2.3. The Relationship between Induction and Analogy

There is a close relationship between analogy and induction. The mind moves from induction (as a synthesis) with the aim of acquiring and gaining knowledge (even if it is preceded by analysis starting from the whole in accordance with the Gestalt principle), to analogy as an analysis at the level of It is more advanced (in its reliance on rational judgments in the form of deduction) than the primary analysis, which relies on mere sensory perception data. Analogy may revert to theoretical data in the form of a law, theory, or rule in the form of a secondary analysis, to induction as the verification of scientific hypotheses based on general principles and general rules that, in turn, come from observation and experimentation, and based on the implementation of a process.

Commonalities that are constant among individuals, such as conducting an experiment, subjecting certain types of metals to heat and concluding (induction) that metals expand with heat, then applying this conclusion (induction) as a law to similar types of metals.

The premises of a syllogism, then, are often in the form of prior inductive judgments. The role of syllogism and the process of induction is evident in the stage of formulating hypotheses selected from observations of natural events. The experiments used to confirm it are inspired by it (the hypothesis) (Al-Jabiri et al., 1971, p.115).

3.2.4. The Thesis of Induction

Aristotle is considered the first to establish the foundation of induction.

Bacon then structured (organized) induction in the form of lists (lists).

Mill then codified (rules and methods) of induction.

Aristotle considered the usefulness of the logical value of induction to be on the same level as the value of syllogism.

Syllogism has a middle term (a middle term), while induction does not (term 1 "specific part", term 2 "all general"), unlike syllogism (each "general" is the middle of a "specific" part).

However, Aristotelian induction is a syllogism (originally, in form);

Also, the examples of particulars of Aristotelian induction are species, not individuals;

Cow, sheep, gazelle,... are ruminants;

Cow, sheep, gazelle,... are horned animals;

All horned animals are ruminants.

Therefore, Aristotelian induction is an inference (proof) for a universal proposition by referring to particular examples to confirm its validity.

Also, Aristotelian induction is not real; rather, it is the deduction of a conclusion equal to the premises. It is a complete induction, i.e., a foregone conclusion (formal, sterile formalism). Its conclusion was not inferred inductively, but rather deduced analogically. Aristotle also considered incomplete induction to be a mutation (the transition from the particular to the general by generalization) accomplished by mere philosophical theoretical intuition (but not proof of deriving a conclusion).

Therefore, Aristotelian induction is accomplished by generalization and mere conjunction (temporary circumstantial repetition) between two phenomena on the basis of general causality (however, this is relative and influenced by habit and chance, not absolute and necessary). It is not specific causality (such as considering heat an absolutely necessary cause of the expansion of iron), and it is in fact a syllogism.

Therefore, Aristotelian induction implies a syllogism; it is, in fact, a syllogistic proof (proceeding from the general to the particular), not an inductive proof (proceeding from the particular to the general).

Incomplete induction is based on experience, unlike Aristotelian intuitive induction, which is based on a philosophical perspective.

Aristotelian induction is also a method for establishing proof of a known truth, not for discovering a new truth. It is a method for convincing opponents (argumentation), not evidence of scientific discovery [which enables prediction of future events] (Dawidar, 2009, pp. 150-161).

4. Scholars' Views on Induction

A. The First Category:

- Aristotle: The first to use the term induction, but he focused on complete induction (a foregone conclusion) and neglected incomplete induction (a sample) in favor of his glorification of syllogism (he attempted to inductively reason while implying a syllogism).

- Bacon: He laid the foundations of induction (lists of research) and adopted the idea of exclusion (elimination).

- Mill: He codified the methods (rules) of induction to verify a hypothesis, relying on the principles of causality and regularity.

- Hume: He raised the problem of the legitimacy of induction and rejected the necessary relationship between cause and effect, attributing it to habit (the sun rises tomorrow), but he did not reject generalization and prediction about the future.

- Russell: He considered the method of induction (synthesis) the basis of scientific research (for pragmatic purposes), but he considered its results probabilistic (uncertain), and he complemented it with the method of deduction (analysis).

- Einstein: He considered induction an incomplete method, so he adopted deduction (analysis) and combined the two (relativity is a deductive theory with an analytical hypothesis).

- Ayer: He considered induction important, but he acknowledged its impossibility of logically justifying it.

- Popper: He rejected induction entirely, considering it a myth, and claimed to offer an alternative method, the hypothetical-deductive critical method, based on the principle of falsification. However, he did not, in fact, dispense with induction; he claimed to be deductive, while in fact implying induction. The principle of falsification cannot be adopted in isolation from induction (Cohen, 1978 p.11).

- Kuhn: Rejects the idea of support for (Bacon and Mill) and refutation (Popper) of induction (Hamdi, 2016, pp. 321-331).

B. The second category:

[Opinions of other scholars] (Mohamed Ali, 1985: 33-65).

Hibben: He believes that (Mill's) method of residuals is deductive because it is based on the law of sufficient reason, but it is based on induction at a stage prior to deduction.

- Carnap: He equates deduction with (Aristotelian) syllogism in **contrast to (reverse) induction.**

- Poincaré: He believes that science is inductive in principle because it relies on generalization, but it is presumptive, not certain.

5. Research procedures:

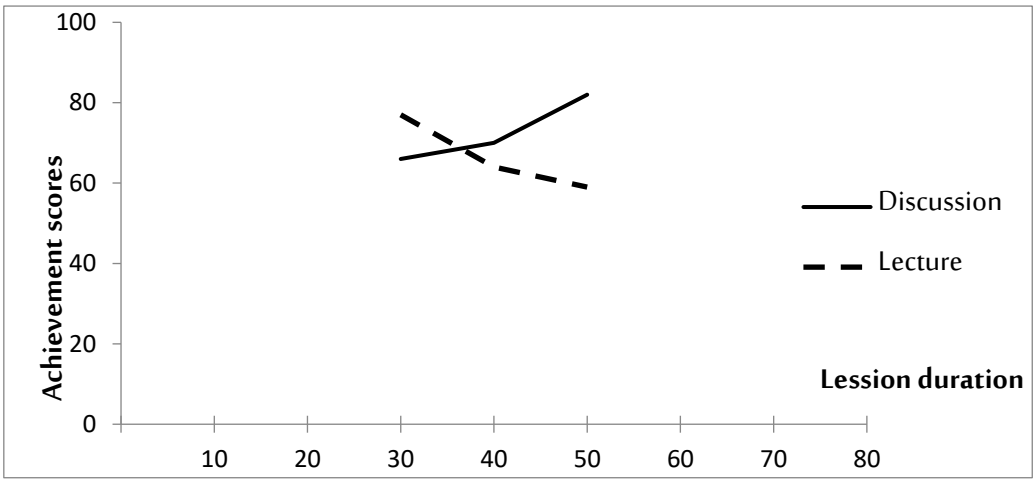

Fig. 1. *Represents the relationship between teaching method and academic achievement. Source: (Aqil, 1982: 149).*

Comment:

From the two graphs, it is clear that the discussion method (which can be extended to the inductive method, as the investigative discussion is based on the inductive research approach in the form of a sensory-synthetic generalization) is more effective than the lecture method (which can be extended to the analogical method, as the inductive lecture is based on syllogistic reasoning in the form of an abstract analytical generalization), as indicated by the achievement results shown above.

6. Discussion (deductive comparison) between methods of teaching Arabic grammar and scientific subjects:

If the appropriate method for teaching the reading activity is the analytical-synthetic method, which some educators call the holistic method, because it begins with a holistic view of the text, the study addresses the phenomenon (the text) as a whole, not its parts. This is in accordance with the Gestalt principle, which states that the whole precedes its parts. The general idea of the text is extracted initially, then the basic ideas are identified, and finally the main idea is extracted.

That is, this method begins with analysis and ends with synthesis. This means that it starts from the whole, progresses to the part or parts, and finally moves to the second whole. However, the second whole is in fact different from the first whole. The first relates to merely dealing with the text as a whole, or at most, extracting its general idea as an analysis. This means that the matter does not go beyond the simple cognitive level of recognition and understanding. The second whole relates to function and a higher intellectual level, represented by synthesis. Scientific knowledge is constructive, not merely descriptive or analytical, but rather generative and innovative. Therefore, it has been said that scientific knowledge is an analysis between two structures, or rather (in other words) a synthesis between two analyses (i.e., a part between two wholes). Therefore, some educators call this method the blended method because it combines both the analytical and synthetic approaches, merging them into a single, integrated method or approach. Hence, in our opinion, its accurate name is the analytical-synthetic method, and not merely a general or comprehensive view of the text,

although this is necessary at the beginning. However, the matter does not stop at the parts, but rather extends to the whole, as the text is reconstructed anew in a new form and the whole is returned to again. After the analysis, the synthesis is carried out periodically.

This is true for reading, and the same can be said for expression. The appropriate method for teaching it is the analytical-synthetic method, as long as it requires engaging with the text. It is analyzed into its elements (ideas), and after examining these elements, it is reconstructed and reconstructed. Thus, we find that the two activities share a common general teaching method, with differences in the detailed stages and steps, and in the techniques for teaching each activity individually, due to its unique nature.

As for grammar activities (syntax, morphology, and spelling), the method of teaching them differs from the method of teaching reading and expression activities. The appropriate and effective method for teaching grammar, given its abstract, standard nature, is the method of induction, which some call deduction. This is despite the fact that both activities belong to a single unit (field) of study, namely the Arabic language unit with its various branches. For example, teaching grammar begins with examples as parts, although these should be extracted from the reading text or the previously studied expression. However, starting from the text as a whole is related to a general pedagogical foundation, in accordance with the Gestalt principle, as mentioned above, rather than the teaching method of this activity. After extracting examples from the text, the teacher begins analyzing them with the participation of the students. These are then recorded on the blackboard to obtain partial conclusions for each element or specific grammatical case (nominative, accusative, and genitive). These partial conclusions are then summed up to arrive at a general conclusion. Thus, the general rule is derived, which encompasses all the previously presented cases. Finally, the teacher asks the students to complete a set of exercises that are supposed to cover all elements of the lesson, as a practical application (employment and investment). Students who have fully understood the lesson and grasped the rule can then use this previous rule and apply it to the set of exercises as new partial cases. This way, they can solve them with ease and convenience. That is, the lesson progresses from the whole (the text) to the part (the examples). The first whole is simple and perceptual, while the second whole is represented by the rule. This latter whole differs from the first whole; the first is simple and perceptual, while the second is abstract and sophisticated. The lesson then concludes with the second part (the exercises), which are structured in the same vein as the examples presented in the lesson. This means that the lesson began with analysis, moved on to synthesis, and concluded with another analysis that differs from the first in nature. The first analysis is merely deconstruction and segmentation (extracting examples from the text), while the second analysis is inferential, or rather analogical, reasoning (application of the rule to new situations and contexts). The intermediate structure between the two analyses is induction, which is the core and foundation of the lesson, as it enables students to acquire and acquire new knowledge. Analogy, on the other hand, serves the purpose of application in any lesson, supporting and complementing induction. Its mission is to consolidate and consolidate the information acquired and the results achieved through induction. Therefore, the appropriate and basic method for teaching grammar is induction, which was adopted as an alternative to the old analogical method.

Therefore, a comparison was made between several teaching methods. The first comparison was between the standard method and the inductive method in the fifth-grade grammar subject.

After presenting a lesson using two different methods to both groups (after controlling for all variables, such as academic level, gender, and intelligence, and introducing the independent variable, represented by the inductive method, to the experimental group), an achievement test was administered to (24) students in the first group (control) and to (24) students in the second group (experimental), following each lesson (sound masculine plural). The evaluation was conducted using a score of 10 as the standard measure for correction (raw score), which was converted to standard scores, awarding 1 point for each question. After obtaining the data, it was analyzed using the statistical analysis of variance method.

Analysis of variance for the results recorded in the attached table:

Table 1. Represents the comparison between the standard method and the inductive method.

Inductive method		Standard method	
$Q1^2$	**Q1**	**$Q1^2$**	**Q1**
25	05	00	00
100	10	01	01
100	10	04	02
49	07	04	02
49	07	09	03
100	10	16	04
09	03	16	04
81	09	16	04
49	07	16	04
25	05	16	04
100	10	36	06
100	10	36	06
81	09	36	06
100	10	49	07
100	10	49	07
49	07	49	07
25	05	49	07
100	10	64	08
100	10	64	08
100	10	81	09
100	10	81	09
100	10	81	09
81	09	81	09
100	10	100	10

1. Calculating the total sum of squares :

$SST = \Sigma X^2 - (T^2 / N)$

$\ = (954 + 1823) - ((136 + 203)^2 / (24 + 24))$

$\ = 2777 - (339^2 / 48)$

$\ = 2777 - 2394.18$

$\ = 382.82$

2. Calculating the sum of squares between groups

$SSW\ (Group\ 1) = \Sigma X_1^2 - (T_1^2 / n_1)$

$\ = 954 - (136^2 / 24)$

$\ = 954 - 770.66$

$\ = 183.34$

$SSW\ (Group\ 2) = \Sigma X_2^2 - (T_2^2 / n_2)$

$\ = 1823 - (203^2 / 24)$

$\ = 1823 - 1717.04$

$\ = 105.96$

Total Within-Groups Sum of Squares

183.34 + 105.96 =289.30

3. Calculation of the Between-Groups Sum of Squares

$SSB = (T_1^2 / n_1) + (T_2^2 / n_2) - (T^2 / N)$

$\ = (136^2 / 24) + (203^2 / 24) - (339^2 / 48)$

$\ = 770.66 + 1717.04 - 2394.18$

$\ = 93.52$

4. Calculating the degrees of freedom:

Total degrees of freedom: $N - 1 = 48 - 1 = 47$

Within-groups degrees of freedom: $N - k = 48 - 2 = 46$

Between-groups degrees of freedom: $k - 1 = 2 - 1 = 1$

5- Table 2: Covariance table

Source of Variation	Sum of Squares	Degrees of Freedom	Estimated Variance
Between Groups	93.52	1	93.52
Within Groups	289.30	46	6.28
Total	**382.82**	**47**	**99.80**

The variance ratio "F" for the difference between the two methods can be obtained by dividing the large estimated variance by the small estimated variance.

F = 93.52/6.28 = 14.89

Variance ratio = 14.89 = 93.52/6.28

Source: Achievement test conducted by the researchers

Comment: This ratio of 14.89 suggests that the difference between the two teaching methods is a fundamental difference between the standard method and the inductive method. Referring to the test results table and the statistical tables at degrees of freedom of 1 and 46, we find that this ratio is significantly higher than the minimum limit for statistical significance (4.05) at the 5% confidence level, and (7.21) at the 1% confidence level.

On this basis, it can be concluded that teaching using the inductive method is more effective than the standard method in grammar (and this can be generalized to science education, which relies on the experimental approach based on induction), confirming our hypothesis.

7- Comparison between the synthetic and analytical methods in science education :

A lesson was presented on the human body, its morphology (external form) and physiology (function), focusing on motor activity using two different methods : synthetic (progressively from the part or specific to the whole or general) and analytical (progressively from the whole or general to the part or specific). This was followed by an achievement test (consisting of 10 questions) administered to 40 students. Their answer sheets were graded based on a maximum score of 10 (as a ceiling), with one point awarded for each question. The results obtained were as follows :

Table 3. Comparison between the synthetic and analytical methods in science education :

Analytical method (Standard)		Synthetic method (inductive)	
$Q2^2$	**Q2**	**$Q1^2$**	**Q1**
00	00	00	00
00	00	00	00
00	00	01	01
00	00	01	01
00	00	01	01
00	00	01	01
00	00	04	02
00	00	09	03
00	00	16	04
01	01	16	04
01	01	25	05
01	01	25	05
01	01	25	05
01	01	36	06
01	01	36	06
01	01	36	06
01	01	36	06
04	02	49	07
04	02	49	07
04	02	49	07
04	02	49	07
04	02	64	08
04	02	64	08

04	02	64	08
04	02	64	08
04	02	81	09
04	02	81	09
16	04	100	10
16	04	100	10
16	04	100	10
25	05	100	10
25	05	100	10
25	05	100	10
25	05	100	10
36	06	100	10
36	06	100	10
64	08	100	10
81	09	100	10
100	10	100	10
00	00	04	02
513	99	2086	256

1. Calculation of the Total Sum of Squares (SST):

$SST = \Sigma X^2 - (\Sigma X)^2 / N$

$\backslash = 2086 + 513 - ((99 + 256)^2 / (40 + 40))$

$\backslash = 1023.68$

Calculation of the Within-Groups Sum of Squares (SSW):

$SSW (Group A) = \Sigma X_1^2 - (\Sigma X_1)^2 / N_1 = 2086 - (256^2 / 40) = 447.60$

$SSW (Group B) = \Sigma X_2^2 - (\Sigma X_2)^2 / N_2 = 513 - (99^2 / 40) = 267.97$

Total Within-Groups SS = 447.60 + 267.97 = 715.57

Calculation of the Between-Groups Sum of Squares (SSB):

$SSB = (\Sigma X_1)^2 / N_1 + (\Sigma X_2)^2 / N_2 - (\Sigma X)^2 / N$

$\backslash = (256^2 / 40) + (99^2 / 40) - ((256 + 99)^2 / 80)$

$\backslash = 308.11$

2. Calculation of Degrees of Freedom (df):

Total: N - 1 = 80 - 1 = 79

Within-Groups: N - k = 80 - 2 = 78

Between-Groups: k - 1 = 2 - 1 = 1

Table 4. ANOVA Table

Source of Variation	Sum of Squares	df	Mean Square
Between Groups	308.11	1	308.11
Within Groups	715.57	78	9.17
Total	**1023.68**	79	**317.28**

Variance ratio F = 308.11/9.17 = 33.58

Comment :

Referring to the statistical tables and considering the degrees of freedom (1.78), we find that the value of 33.58 is significantly higher than the threshold for statistical significance, which ranges between 3.96 and 3.98 at the 5% confidence level, and between 7.01 and 6.96 at the 1% confidence level.

This means that the difference in results did not arise by chance. Rather, the difference in teaching methods caused substantial differences in the results. Based on this, the synthetic (inductive) method is better and more effective than the analytical (analytical) method, which confirms our hypothesis.

8- Conclusions

From this, we conclude that induction is based on synthesis, while measurement is based on analysis. However, not all synthesis is induction, just as not all analysis is measurement. Every induction is a synthesis, and every measurement is an analysis. Induction is more comprehensive than mere synthesis, and measurement is more comprehensive than mere analysis.

This applies to reading, along with expression and grammar, as linguistic activities. As for scientific activities, represented by mathematics and science education, and their relationship to each other, we affirm another scientific fact : the teaching methods for these two activities differ significantly from one another. While we find that mathematics is primarily suited to the deductive method, we find science education, on the contrary, more suited to the inductive method. This is because the nature of the subject determines the appropriate method, as is well-known and established. The teaching of science education relies primarily on observation and experimentation, and the core of the experimental method is induction, progressing from partial to comprehensive cases, or rather, from the specific to the general. It begins with concrete examples and partial tangible samples to arrive at the general law that includes and encompasses them, as it moves from observing the phenomenon as a whole to posing a question or hypothesis that explains the reason behind the occurrence of this phenomenon that raises a problem, then it proceeds to conduct and carry out the experiment that confirms or denies the hypothesis and from there to extract and deduce the general law or general theory (the water cycle in nature). This means that there is analysis followed by synthesis as well. This synthesis is what represents induction, as analysis is proceeded according to from observation to hypothesis, while synthesis rises from hypothesis to law and is the most important in this process. Therefore, it was decided that the appropriate and effective method for teaching natural sciences is the inductive method.

Hence, it becomes clear that both science education and grammar education share a common general method, despite the differences in their detailed stages, depending on the nature of each activity. Science education is based on observation and experimentation, while language study is based on analysis and deduction. Despite the differences in classification and epistemological affiliation, the former is scientific and the latter linguistic. This corrects and refutes the claim that there is a complete separation between linguistic and scientific subjects. From this, we conclude that there is a significant overlap between the two fields. As for mathematics, despite what is known about its appropriate method being deductive, which is the opposite of inductive, scientific analysis has proven that deduction has two approaches: the analytical approach, which is represented by analogy and is appropriate for teaching arithmetic and algebra, and the synthetic approach, which is based on induction and is primarily appropriate for teaching geometry. It should be noted that there is a significant discrepancy between mathematical induction, which is a priori certainty, and the second type, experimental induction, which is a posteriori conjecture based on generalization that may escape the law of regularity. This has led some scholars to deny the existence of induction in mathematics, and even syllogism. They have gone so far as to say that the matter amounts to nothing more than analysis and synthesis in addressing mathematical problems. We tend to acknowledge the existence of syllogism and induction in mathematics in its simplest forms, and in accordance with the specific nature of this subject itself. Finally, we should point out that mathematical deduction is fertile and productive, unlike formal logical syllogism, which is merely a foregone conclusion. Thus, we conclude that expression activities share a common teaching method with reading, while they differ from the teaching method of grammar, morphology, and spelling, despite their belonging to the same linguistic unit. We also find that the teaching method of science education differs from the teaching method of mathematics, while we find that both science education and grammar share a common general teaching method, namely the induction method, despite the fact that each belongs to a different study unit in terms of pedagogical and didactic organization. We also find a degree of similarity between mathematics, on the one hand, and reading and expression, on the other, in their general teaching method, as they are both based and dependent on analysis and synthesis. In short, we find that mathematics intersects with both reading and expression, while science education intersects with Arabic grammar in their teaching method.

9- Conclusion

Through a systematic approach to teaching Arabic grammar activities (syntax, morphology, and spelling), we find that the appropriate and effective method for this, by its very nature (despite its abstract nature), is the induction method, which begins with examples as parts (even if they are extracted from the text in accordance with the textual approach). These examples are then analyzed by the teacher with the participation of the students. After they are recorded on the blackboard, the results are then analyzed to obtain the partial conclusions for each grammatical case (nominative, accusative, or genitive). The process of summarizing these examples is then carried out to arrive at a general conclusion. Thus, the general rule is

deduced, which encompasses all the previously presented cases. This is also the case for science education activities, for which the induction method is also appropriate due to its material nature, which is based on the experimental approach, which relies on observation and sensory testing. It progresses from individual cases (hypotheses) to comprehensive cases (laws, theories), which it encompasses, moving from the specific to the general. It begins with concrete examples and the examination of concrete samples to arrive at the general law that encompasses and encompasses them. Hence, it becomes clear that both the Arabic grammar and science education activities share one general method, despite the differences in their detailed stages from one activity to another.

Suggestions

Before concluding this research, we should offer several suggestions that may resolve the problem under study and contribute to advancing the educational process, developing and improving it in light of the results obtained :

- Incorporating a scale addressing specific teaching methods (educational-didactic) into the scales prescribed for students majoring in education and psychology, in addition to a scale for general teaching methods.

- Organizing periodic internships (training) conducted in educational institutions outside of universities in general and training institutes in particular.

- Assigning students majoring in education to deliver experimental lessons in university classrooms and to conduct field research and investigations.

- Reopening training institutes (residential, not rotational) to enhance the feasibility and effectiveness of the training process.

- Adopting microteaching (application and evaluative observation) with feedback.

Expanding research is anticipated to clarify the thorny relationship between induction, deduction, and conclusion [epistemology and methodology], clarifying the differences and removing the ambiguity between these terms, in light of contemporary studies.

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