

The Impact of the (M.S) and (Z.M) Models on the Acquisition of Arabic Grammar Rules among Second Intermediate Grade Students

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Abstract: *This study examined the effectiveness of the Mental Stimulation (M.S) model, which is based on the cognitive acceleration approach of Adey and Shayer, and Zimmerman's self-regulated learning (Z.M) model on the achievement of Arabic grammar rules among second intermediate grade female students. A quasi-experimental design with two experimental groups and one control group and a post-test was adopted. The sample comprised 90 students of a girls' intermediate day school of the General Directorate of Education in Babil Governorate, Iraq, in the 2023–2024 academic year; the three classes were randomly assigned to the M.S group, the Z.M group and a control group taught by the conventional method. The groups were statistically equated in chronological age, previous achievement in the Arabic language and Raven's intelligence test. A 40-item multiple-choice achievement test was constructed; its face and content validity were established by expert judgement, and its split-half reliability reached 0.86 after Spearman–Brown correction. One-way ANOVA revealed a statistically significant difference among the three groups ($F(2, 91) = 8.659, p < 0.05, \eta^2 = 0.16$). Scheffé post hoc comparisons showed that both the M.S group ($M = 25.45$) and the Z.M group ($M = 27.24$) outperformed the control group ($M = 21.07$), whereas the difference between the two experimental groups was not significant. The findings indicate that both models are effective alternatives to conventional grammar instruction, and the study recommends training Arabic language teachers in their classroom application.*

Key words: *M.S model; Z.M model; cognitive acceleration; self-regulated learning; academic achievement; Arabic grammar; second intermediate grade.*

Introduction

Education is regarded as the instrument through which a society transmits its culture, translates its principles into practice and prepares its members to interact with the environment in which they live. Modern educational institutions are therefore expected to move from instruction centred on the curriculum or the teacher towards learning centred on the student, seeking the comprehensive intellectual, physical, emotional, social and spiritual growth of learners so that new generations become capable of innovation and renewal [1]. The curriculum is the vehicle of this philosophy: it is the essence of education, the point that connects students with the surrounding world and the tool through which society accomplishes its goals and aspirations [2]. Contemporary frameworks of curriculum development accordingly treat the student as the focus of the educational process and require sustained attention to employing and developing new teaching strategies [3].

Language occupies a special place within the curriculum. It is not merely a means of communication but the identity of a nation and the container of its civilisation, so that any deterioration in its mastery hinders the intellectual and scientific development of society [4]. Through language the cultural heritage is transmitted from one generation to another, and students are

introduced both to the legacy of their own nation and to that of other nations [5]. Grammar, in turn, is the backbone of correct expression in Arabic, which makes the quality of grammar instruction a matter of direct concern for Arabic language education.

Research problem

Despite this importance, the achievement of many students in Arabic grammar remains below the level required by the objectives of the educational process. A decline in students' grammatical performance and weaknesses in the ways grammar is taught and learned were documented by Al-Saadi [6], by Al-Sultani [7], by Al-Dahlaki [8] and, more recently, by Al-Shaheed [9]. These studies also point to the limited use of modern models and strategies by Arabic language teachers. When grammar is taught in a dry, transmissive manner it fails to arouse students' interest or activate their role in learning, whereas modern strategies can stimulate enthusiasm and facilitate the attainment of the desired goals.

Teaching methods matter for the teacher, the student and the curriculum alike: an appropriate method organises the teaching process, allows the student to progress in an orderly manner, compensates for weaknesses in the curriculum, reduces anxiety and distraction and increases motivation and attention [10]. Knowledge of contemporary strategies enables teachers to take into account the individual differences among students and to diversify learning experiences on the basis of students' activity [11]. Such differences are considerable, since learners arrive at school with different experiences and from different environments [12]. It is therefore no longer acceptable to adhere to traditional methods based on memorisation and lecturing merely because they are easy to implement [13]. Educators have instead emphasised models that give students an active role through activities carried out in small groups and that create meaningful learning based on understanding [14], and they call for teachers who continuously develop their practice in line with the demands of the contemporary era [15].

The (M.S) and (Z.M) models are among the recent models consistent with these trends. Accordingly, the research problem was formulated in the following question: **How effective are the (M.S) and (Z.M) models in the acquisition of Arabic grammar rules by second intermediate grade students?**

Theoretical background

Constructivist foundations. Cognitive constructivism takes Jean Piaget as its point of departure. Piaget held that the learner develops levels of thinking through successive stages, each characterised by particular mental structures, and that these structures mediate between the learner and the environment and become able to explain new experience as the learner gains it [16]. Piaget's comprehensive theory of cognitive development has inspired many teaching methods and models that educators have sought to apply in classrooms [17].

The (M.S) model. The model originated in the 1970s at Chelsea College, London, where a team including Michael Shayer and Philip Adey conducted large-scale surveys of students' levels of thinking and developed the Cognitive Acceleration through Science Education (CASE) project on the basis of Piaget's account of cognitive stages and Vygotsky's social view of learning [18]. Acceleration of thinking is described as a way of transferring students from lower to higher levels of thinking by engaging them in group discussion [19], and long-term follow-up showed that such intervention produced lasting gains in formal thinking and later academic achievement [20]. Interaction with peers enables the student to acquire new knowledge, skills, values and ways of thinking, raises the level of cognitive activity and strengthens self-confidence as the student expresses his or her opinion before others [21]. In this model the good teacher encourages students to construct their own knowledge, confronts them with authentic situations that require novel solutions through investigation and social negotiation, and organises the learning environment [22]. The model has also been defined as a combination of content and instructional method that stimulates students to analyse, infer and solve problems through experiments or through discussing task cards with peers, while connecting knowledge with real-life situations [23].

The M.S model is implemented in four steps. (1) *Preparation and discussion*: the teacher divides students into groups, presents the general framework of the problem, introduces the new terms of the lesson and builds a common language of understanding, acting as director of activities rather than as a mere source of information [24]. (2) *Cognitive conflict*: the central step of the model, in which students face a problem that cannot be solved with their usual ways of thinking, so that a contradiction arises between prior knowledge in the cognitive structure and new, scientifically sound knowledge [25]; the resulting surprise generates curiosity and drives students towards a new cognitive equilibrium. (3) *Metacognition (thinking about thinking)*: through questions such as “Why did you think that?”, students become aware of the reasoning they used, organise their thoughts and integrate new knowledge with prior experience. (4) *Bridging*: students connect what they have learned with other subjects and with everyday life, which transfers learning from the theoretical to the practical dimension and sustains motivation.

The (Z.M) model. Zimmerman’s model views learning as a self-directed activity that requires active participation, motivation and metacognitive processes. Its social-cognitive formulation describes a cyclical process of three phases: forethought (goal setting and strategic planning), performance or volitional control (self-instruction, attention focusing, self-monitoring and self-recording) and self-reflection (self-evaluation, causal attribution and adaptation) [26]. Intrinsic motivation is fundamental to this process, because students who learn for an inner purpose undertake tasks with pleasure and persistence; where it is weak, external incentives may be used temporarily and gradually converted into intrinsic ones [27]. Self-regulated learning thus comprises the cognitive, metacognitive and resource-management strategies, including the management of time and study environment, that students employ to obtain a desired learning outcome [28]. In the present study the model was implemented through four classroom steps: planning and goal setting, task execution with self-monitoring, adjustment of strategies in the light of progress, and self-evaluation of performance against the goals set.

Academic achievement. Achievement is one of the most widely used concepts in education and educational psychology because it is a fundamental criterion for judging students’ academic performance and the quantity and quality of educational output; it is also a complex outcome influenced by many interacting factors [29]. It is defined as the outcome of what the student learns after a certain period, measured by the grade obtained in an achievement test, which also indicates how well the teacher’s strategy has attained the intended objectives [30]. Its importance extends beyond passing examinations to shaping the student’s choice of study and occupation and his or her future role in society [31].

Previous studies. Table 1. summarises previous studies that examined the two models.

Table 1. Previous studies related to the (M.S) and (Z.M) models

No.	Researcher	Aim	Stage	Sample	Instruments	Main findings
1	Endler and Bond [32]	Effectiveness of the (M.S) model in accelerating cognitive development and improving achievement	Secondary	141 male and female students	Cognitive development test; achievement test	Experimental group outperformed the control group
2	Al-Tamimi [33]	Effect of the (Z.M) model on fifth-grade science students’	Preparatory	63 students	Achievement test; perceived self-efficacy scale	Experimental group outperformed the control group

No.	Researcher	Aim	Stage	Sample	Instruments	Main findings
		achievement in biology and perceived self-efficacy				

Aim and hypothesis

The study aimed to identify the effectiveness of the (M.S) and (Z.M) models in the acquisition of Arabic grammar rules by second intermediate grade students. To achieve this aim, the following null hypothesis was tested: *There is no statistically significant difference at the 0.05 level among the mean achievement scores of the first experimental group taught by the (M.S) model, the second experimental group taught by the (Z.M) model and the control group taught by the conventional method in the Arabic grammar achievement test.*

Materials and Methods

Research design

A quasi-experimental design with two experimental groups, one control group and a post-test was employed, because the experimental approach is among the most accurate and efficient scientific methods for obtaining trustworthy results. The first experimental group was taught according to the (M.S) model, the second experimental group according to the (Z.M) model and the control group by the conventional method (Table 2).

Table 2. Experimental design of the study

Group	Equivalence variables	Independent variable	Dependent variable	Instrument
First experimental	Chronological age (months); previous achievement in Arabic; Raven's intelligence test	(M.S) model	Achievement	Achievement test
Second experimental	As above	(Z.M) model	Achievement	Achievement test
Control	As above	Conventional method	Achievement	Achievement test

Delimitations, population and sample

The study was delimited to: (a) second intermediate grade female students in public day schools of the General Directorate of Education in Babil Governorate; (b) the academic year 2023–2024; and (c) nine topics of the Arabic Grammar Rules textbook for the second intermediate grade prescribed by the Iraqi Ministry of Education for that year. The research population consisted of all second intermediate grade girls in public day schools of the Directorate. The Directorate was selected intentionally because the researcher resides and works in the governorate, and one girls' intermediate school was chosen after consulting the Educational Planning Department. The school included 90 second intermediate grade students distributed over three classes of 30 students each. Class (A) was randomly assigned as the first experimental group (M.S model), class (B) as the second experimental group (Z.M model) and class (C) as the control group (conventional method).

Operational definitions

Effectiveness has been defined as the desired or expected impact of learning on performance resulting from the use of particular teaching methods [34]; operationally, it is the level of cognitive performance the student achieves as a result of applying the two models. A *model* is a set of instructional principles that provides a framework for understanding the nature of the learning process [35]; operationally, it is the ordered series of steps the researcher applied with the two experimental groups when teaching Arabic grammar. The *(M.S) model* is operationally the four-step procedure (preparation and discussion, cognitive conflict, metacognition and bridging) followed with the first experimental group. The *(Z.M) model* is operationally the organised, sequential procedures based on forethought, performance and self-reflection followed with the second experimental group. *Achievement* is operationally the score obtained by the students in the Arabic grammar achievement test constructed by the researcher.

Equivalence of the groups

Although all participants were girls from the same school and similar socio-economic backgrounds, the three groups were statistically equated using one-way ANOVA in chronological age (months), final Arabic language grades of the previous year (2022–2023) and Raven’s intelligence test. As Table 3 shows, none of the calculated F-values reached the tabulated value (3.07) at the 0.05 level, indicating that the groups were equivalent.

Table 3. One-way ANOVA for the equivalence of the three groups

Variable	Source of variance	df	Sum of squares	Mean square	F (calc.)	F (tab.)	Significance (0.05)
Chronological age	Between groups	2	15.193	7.596	0.191	3.07	Not significant
	Within groups	88	3625.924	39.845			
	Total	90	3641.117				
Previous achievement	Between groups	2	19.550	9.777	0.057	3.07	Not significant
	Within groups	88	15598.190	171.409			
	Total	90	15617.740				
Raven’s test	Between groups	2	51.140	25.570	0.913	3.07	Not significant
	Within groups	88	2547.977	27.999			
	Total	90	2599.117				

Control of extraneous variables

In addition to statistical equivalence, the researcher controlled several factors that might threaten internal validity: experimental mortality (no student withdrew or was absent for long periods), selection of the sample, maturation (the experiment lasted a single semester for all groups), incidental events, the measuring instrument (the same test was administered to all groups at the same time) and experimental procedures (the same teacher, timetable, content and classroom conditions were used

for the three groups).

Instructional materials

The scientific content comprised nine topics of the prescribed Arabic Grammar Rules textbook for the second intermediate grade (2023–2024), including the original and secondary signs of inflection, the five nouns, the transitive and intransitive verb, the agent's deputy and the verb in the passive voice. The researcher formulated 89 behavioural objectives distributed over four levels of Bloom's taxonomy (remembering, understanding, applying and analysing) and submitted them to experts in measurement, evaluation and teaching methods; objectives obtaining at least 80% agreement were retained. Thirty lesson plans were then prepared for the three groups, reviewed by the experts and modified in the light of their suggestions.

Research instrument

An achievement test was constructed to measure the dependent variable. After reviewing previous experimental studies at the intermediate stage, the test was fixed at 40 multiple-choice items with four alternatives each, distributed across the nine topics and the four cognitive levels according to a table of specifications. Instructions for students and scoring instructions were prepared: one point was awarded for each correct answer and zero for an incorrect, omitted or multiply-marked item, giving a score range of 0–40.

Validity. Face validity was established by presenting the test to experts in measurement, evaluation and methods of teaching Arabic; all items achieved at least 80% agreement and none was removed, although some were reworded. Content validity was ensured through the table of specifications linking the items to the behavioural objectives, which was reviewed together with the answer key by the same experts.

Pilot application and item analysis. The test was first administered to 30 second intermediate students of another school in Babil to check the clarity of items and instructions and to estimate the time needed; items and instructions proved clear, and the average response time was calculated. A second pilot sample of 100 students was used for item analysis. Difficulty indices ranged between 0.37 and 0.70, discrimination indices between 0.33 and 0.52, and all distractors were effective, with values between –0.07 and –0.37.

Reliability. Using the split-half method, the Pearson correlation between the two halves was 0.75, which rose to 0.86 after correction by the Spearman–Brown formula, indicating good reliability.

Statistical analysis

Data were analysed with SPSS. One-way ANOVA was used for group equivalence and for testing the hypothesis, eta squared (η^2) was computed as the effect size, and the Scheffé test was applied for post hoc comparisons. Item difficulty, discrimination and distractor effectiveness equations, the Pearson correlation coefficient and the Spearman–Brown formula were used in constructing the test.

Results

The mean score of the first experimental group (M.S model) in the achievement test was 25.45 (SD = 6.34), that of the second experimental group (Z.M model) was 27.24 (SD = 5.48), and that of the control group was 21.07 (SD = 6.23) (Table 4, Figure 1).

Table 4. Means and standard deviations of the three groups in the achievement test

Statistic	First experimental (M.S)	Second experimental (Z.M)	Control (conventional)
Mean	25.45	27.24	21.07
Standard deviation	6.34	5.48	6.23

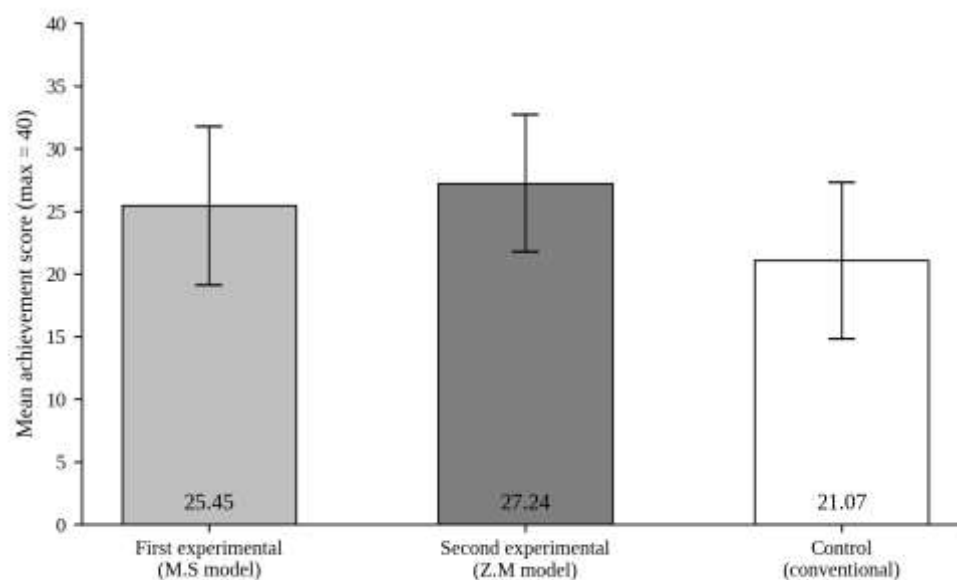


Figure 1. Mean achievement scores of the three groups (error bars = ± 1 SD)

One-way ANOVA yielded a calculated F-value of 8.659, which exceeds the tabulated value of 3.07 at the 0.05 level with degrees of freedom (2, 91), indicating statistically significant differences among the three groups in grammar achievement (Table 5). The null hypothesis was therefore rejected. The effect size was $\eta^2 = 0.16$, which represents a large effect of the independent variable on achievement.

Table 5. One-way ANOVA of the three groups in Arabic grammar achievement

Source of variance	df	Sum squares	Mean square	F (calc.)	F (tab.)	Significance (0.05)
Between groups	2	626.821	313.410	8.659	3.07	Significant
Within groups	91	3293.605	36.193			
Total	93	3920.426				

To determine the direction of the differences, the Scheffé test was applied (Table 6). The first experimental group significantly outperformed the control group (calculated value 4.050 > critical value 2.48), and the second experimental group also significantly outperformed the control group (8.280 > 2.48). The difference between the two experimental groups was not statistically significant (0.708 < 2.48), although the mean of the Z.M group was slightly higher.

Table 6. Scheffé post hoc comparisons among the three groups

Comparison	n	Means	Scheffé (calc.)	Scheffé (tab.)	Significance (0.05)
M.S vs control	31 / 30	25.45 / 21.07	4.050	2.48	Significant
Z.M vs control	33 / 30	27.24 / 21.07	8.280	2.48	Significant
M.S vs Z.M	31 / 33	25.45 / 27.24	0.708	2.48	Not significant

Discussion

The results show that students taught Arabic grammar with either the (M.S) or the (Z.M) model achieved significantly higher scores than those taught by the conventional method, while the two models did not differ significantly from each other. This pattern agrees with the previous studies

summarised in Table 1, in which the experimental groups taught by the same models outperformed their control groups in secondary and preparatory school contexts, and it extends those findings from science subjects to Arabic grammar.

The advantage of the (M.S) model can be explained by its core mechanisms. Cognitive conflict placed students before grammatical cases that could not be resolved with their habitual reasoning, which motivated them to reorganise their knowledge of grammatical rules; metacognitive questioning made them aware of how they reached a judgement about a grammatical case; and bridging linked each rule to language use in reading, writing and daily expression. Comparable gains in conceptual understanding and visual–spatial perception were reported when the Adey and Shayer model was applied to geometric transformations [36], which suggests that the model's effect is not restricted to a single subject.

The effect of the (Z.M) model may be attributed to the fact that students set their own learning goals, monitored their progress through each grammar topic and evaluated their performance against those goals. Such self-regulated learners are proactive, seek help when needed and adjust their strategies in response to feedback, which enables them to consolidate procedural rules of the kind that dominate Arabic grammar [37]. The slightly higher mean of the Z.M group, although not significant, may reflect the suitability of explicit goal setting and self-monitoring for rule-based content.

Both models also changed the social organisation of the lesson. Working in small groups made students the focus of the educational process, gave them confidence to discuss and express their opinions without fear of giving wrong answers and allowed peers to correct one another after reaching a better understanding. A communicative classroom environment that engages all of the learner's senses and uses language suited to the learners' developmental level is a precondition for achieving the objectives of instruction [38], and both experimental conditions provided such an environment.

Several limitations should be noted. The study was conducted with female students in one school of a single governorate, the post-test measured achievement only, and the experiment lasted one semester without a delayed retention test. Generalisation of the findings to male students, other grades and other governorates should therefore be made with caution.

Conclusion

The study concluded that the (M.S) and (Z.M) models are effective in raising the grammar achievement of second intermediate grade students compared with the conventional method, and that neither model is significantly superior to the other. Cooperative group work embedded in both models strengthened team spirit, promoted a high level of cognitive activity and provided a suitable atmosphere for practising thinking, which was reflected in students' classroom performance and test results.

In the light of these findings, the study recommends: (1) organising training courses for Arabic language teachers to introduce them to modern teaching models in general and to the (M.S) and (Z.M) models in particular; and (2) adopting cooperative group work in grammar lessons so that students become active participants who receive knowledge from both peers and the teacher. Future research may (1) examine the effect of the two models on other dependent variables such as types of thinking, motivation, curiosity, attitudes towards grammar and self-learning skills, and (2) replicate the study with male students and at other educational stages.

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