

## The Effectiveness of a Constructivist Educational Program Based on the Curry Model on the Academic Achievement of Students in Colleges of Education Majoring in Educational Technology

Dr. Saad Ali Zayer<sup>1</sup>, Afrah Jalal<sup>2</sup>

### Abstract

*The aim of this research is to develop an educational program based on the Curry model for improving the academic achievement of students majoring in educational technology in colleges of education. The effectiveness of the program, based on the Curry model, in enhancing the academic achievement of students majoring in educational technology is also examined. The researcher employed a descriptive approach to develop the educational-learning program based on the Curry model and an experimental approach to assess the effectiveness of the program based on Curry's model. The research population consisted of third-year students in colleges of education for humanities, specializing in educational and psychological sciences, for the academic year 2022-2023. The research sample size was determined, and to achieve the research objectives, the researcher constructed an achievement test for educational technology. The test's psychometric properties, including reliability, validity, item difficulty, and discrimination power, were assessed. The test consisted of 50 items, including 40 multiple-choice items and 10 short-answer essay questions. Statistical analysis of the data was conducted using the independent samples t-test. The results revealed the following: Students in the experimental group who learned according to the educational program based on the Curry model (Curry, 1983) outperformed the control group, which was taught using material prepared by the researcher following the traditional method of teaching educational technology. Based on the findings of this research, the researcher arrived at several conclusions, recommendations, and suggestions.*

**Keywords:** Educational Program, Curry Model, Educational Technology, Academic Achievement, Colleges of Education.

### 1- Introduction

#### Research Problem

The researcher conducted surveys of both educators and students who were involved in teaching and studying educational technology in colleges of education during the academic year 2021-2022. The surveys aimed to identify the problems and challenges they face in teaching and learning educational technology. Based on the findings, the researcher seeks to conduct a study with the objective of developing a comprehensive educational-learning program that incorporates strategies, activities, educational aids, and diverse assessment methods to effectively present the subject matter. Thus, the current

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<sup>1</sup> Department of Educational and Psychological Sciences, Ibn Rushd College of Humanities, University of Baghdad, Iraq, Saad.ali@ircoedu.uobaghdad.edu.iq

<sup>2</sup> Department of Educational and Psychological Sciences, Ibn Rushd College of Humanities, University of Baghdad, Iraq, Afrahja11e12022@gmail.com

research problem is framed as follows: Does the educational-learning program, using the Curry model, prove effective in enhancing the academic achievement of students majoring in educational technology in colleges of education?

#### Research Significance

The aim of the educational process is to find ways to educate students in various subjects through educational institutions and systems, thereby enhancing their ability to represent, encode, store, and retrieve information correctly within their cognitive structures. The success of these institutions lies in developing educational programs that provide students with facts, concepts, theoretical and practical experiences through methods aligned with modern teaching trends (Sabri, Radhi, R.I., 2021, p. 1291).

Educational programs, including educational materials, enrichment activities, evaluation tools, and suitable classroom environments, as well as modern teaching strategies, play a pivotal role in shaping and enhancing positive relationships within the academic environment. This is particularly crucial in colleges of education because their graduates will assume leadership roles in teaching and educating future generations, thereby contributing to the transfer of knowledge to a broader society (Zayir et al., 2014, p. 22).

Educational programs have proven to be successful tools in addressing disorganized and unstructured education. They help in organizing the processes and steps of the teaching and learning experience, avoiding excessive accumulation of knowledge and information, and emphasizing the importance of illustrative examples and educational activities that bridge the gap between theoretical and practical knowledge. Additionally, they employ continuous and final evaluation methods that highlight the roles of both the teacher and the student in the learning process, identifying effective solutions to educational challenges (Al-Zubaidi, 2014, p. 67).

#### Research Objectives:

This research aims to achieve the following primary objectives:

1. To develop an educational program based on the Curry model for enhancing the academic achievement of students majoring in educational technology in colleges of education.
2. To assess the effectiveness of the program based on the Curry model in enhancing the academic achievement of students majoring in educational technology in colleges of education.

#### Research Hypothesis

The research hypothesis represents the initial assumption regarding the expected results based on the stated objectives. In this research, the hypothesis is as follows:

"There are no statistically significant differences at the 0.05 level of significance between the mean scores of the experimental group students who will learn according to the educational-learning program based on the Curry model and the mean scores of the control group students who will study the subject matter prepared by the researcher using traditional methods in the two-dimensional achievement test."

#### Scope of the Research

This research is confined to the following boundaries:

1. Third-year students in colleges of education for humanities, specializing in educational and psychological sciences.
2. The academic year 2020-2021
3. The content of the educational technology subject matter as prescribed for the third year.

#### Definition of Terms:

##### - Learning Program (Teaching):

- Theoretical Definition: An integrated action plan built upon predefined theoretical foundations, encompassing educational objectives, educational content, teaching strategies, educational activities, instructional aids, as well as assessment methods, all aimed at enhancing the educational process within a specified timeframe.

- Operational Definition: A comprehensive educational-learning system comprising six educational units developed by the researcher based on the Curry model, which is part of the Constructivist theory for educational technology. These units include general and specific learning objectives, educational content, educational-learning strategies, in-class and out-of-class activities, instructional tools, and assessment methods. The researcher implemented these units for a complete academic semester with the goal of elevating the academic and cognitive level of third-year students majoring in Educational and Psychological Sciences at the College of Education, Wasit University, and improving their academic achievement.

##### - Curry Model (Curry):

- Theoretical Definition: A pedagogical model concerned with how students (learners) process their information and knowledge, guiding their learning based on their learning style. It encourages self-organization of information and experiences presented to them through specific course content.

- Operational Definition: An educational-learning model based on Constructivist theory, comprising strategies for organizing and processing information, which serve as both educational and cognitive activities. The researcher employed this model for third-year students majoring in Educational and Psychological Sciences at the College of Education, Wasit University, to achieve the objectives of the Educational Technology subject and assist them in improving their academic achievement.

##### Achievement:

- Theoretical Definition of Achievement: The amount of theoretical knowledge and information related to a specific subject that a student acquires after being taught a predefined educational program. It is measured through post-assessment using a specific achievement test designed for this purpose to determine the extent to which the program's objectives have been achieved.

- Operational Definition of Achievement: The extent of knowledge and application acquired and applied by third-year students in the Department of Educational and Psychological Sciences at the College of Education, Wasit University, in the subjects of the Educational Technology course. This is measured by the grades they obtain in the post-assessment conducted by the researcher at the end of the experiment. The assessment aligns with Bloom's six cognitive levels, namely, recall, understand, apply, analyze, evaluate, and create.

##### Educational Technology Subject:

- Theoretical Definition of Educational Technology Subject: An educational course prescribed by the Ministry of Higher Education and Scientific Research for third-year students majoring in Educational and Psychological Sciences at colleges of education. It encompasses a range of experiences, cognitive knowledge, and various traditional and modern educational resources. These resources aid university students in increasing their knowledge, problem-solving abilities, and their competence in processing information and knowledge presented to them.

- Operational Definition of Educational Technology Subject: The subject of the program that the researcher experimented with, which was taught to third-year students majoring

in Educational and Psychological Sciences at the College of Education, Wasit University. It consists of six instructional units containing cognitive knowledge and information. The researcher taught these units to the research sample over a complete academic semester. This subject is important for enhancing their knowledge, improving their information processing abilities, utilizing multiple senses for learning, which aids in prolonged learning retention, time and effort saving, cost-effectiveness, problem-solving, and the development of their thinking skills.

## **2- Theoretical Framework**

### **1. The Educational-Learning Program**

- The educational-learning program constitutes a principal component within the educational technology system. It is alongside the processes of analysis, development, implementation, management, and evaluation. The educational program serves as a bridge connecting theoretical frameworks from various learning theories, philosophies, and practical aspects in the educational field (Saraya, 2007: 21).

- The educational-learning program encompasses a set of activities and procedures aimed at planning the educational situation within a specific objective. It is connected to a defined timeframe and measurable steps. These activities are designed to be implemented individually or collectively in a comprehensive, long-term educational situation that achieves specific and calculable outcomes or broader objective dimensions (Al-Zand, 2004: 38).

#### **Benefits of Building an Educational-Learning Program**

1. The educational-learning program is directed towards a designed goal while taking into consideration the learning patterns of the learners and the outcomes.
2. It ensures the achievement of standards and helps learners successfully reach their academic and age-level standards.
3. It enhances the teaching process by enabling teachers to find new ways to teach their subjects of interest.
4. It improves learner outcomes, aligning the educational program with learners' learning methods, which theoretically should enhance their performance in the classroom (Diego, 2022, p.58).

#### **Principles of Building the Educational-Learning Program**

1. Developing learners in all aspects of their personalities while considering their individual characteristics.
2. Effective teaching and a focus on learners' self-activity.
3. Providing tools, devices, opportunities, games, and educational services to develop self-learning skills.
4. Guiding and encouraging innovation and creativity in learners in an integrated manner.
5. Providing opportunities for the development of the moral and social aspects within social learning groups (Al-Nashif, 2007: 18).

#### **Stages of Building the Educational-Learning Program:**

##### **1. Analysis Stage**

- The analysis stage refers to organizing, analyzing, and studying the data and information that should include the foundations of the educational-learning program. It is a crucial step in building educational programs as it identifies the educational needs of learners, analyzes the resources to be utilized, and pinpoints any obstacles that may

hinder the program's development. This stage also helps in determining the educational content (Qatami, 2000: 5.2).

## 2. Implementation Stage:

- In this stage, the program that has been built is put into actual practice under real conditions. Teaching is carried out in the classroom, ensuring that all activities are conducted with quality and precision. The significance of this stage lies in determining the suitability of the program, its components, and educational content in real-world conditions. This requires that the person responsible for the implementation be well-trained in teaching and data collection related to the educational-learning process (Qatami, 2000, 140-142).

## 3. Evaluation:

### - Preliminary Evaluation:

- This type of evaluation is also referred to in educational and psychological literature as preliminary, pre-primary, or prior evaluation. It aims to evaluate the learning process before it begins and is intended to assess the learners' starting level and their readiness.

### - Formative Evaluation:

- This type is applied during the implementation of the educational program to discover positives for reinforcement and identify negatives for remediation. Its purpose is to develop what is being evaluated, such as the learners, the educational program, scientific teaching methods, and teaching techniques, and to determine the extent to which learners progress towards achieving the objectives.

### - Summative Evaluation:

- Also known as final or cumulative evaluation, this type is applied at the end of the program. It aims to measure the outcomes, efficiency, and effectiveness of the entire educational program (Asmaa, 2016).

## Elements of the Educational-Learning Program:

### First: Objectives:

- Objectives represent the first and most crucial element of the educational-learning program. They are intricately linked to the other elements. The clearer and more precise the objectives, the more they assist in determining the rest of the elements (Asmaa, 2016).

### Second: Educational Content:

- This element comprises a collection of information, facts, concepts, generalizations, values, attitudes, beliefs, and skills included in the educational-learning program. It represents the totality of cognitive, emotional, and skill-related aspects of education.

### Third: Teaching Strategies:

- Teaching strategies are an essential part of the educational-learning program, helping learners achieve their educational goals. They are closely linked to the objectives and content.

### Fourth: Educational Resources:

- Educational resources encompass materials, tools, electrical devices, and all electronic equipment provided by the teacher under specific conditions and resources in a particular educational setting. These resources assist learners in achieving the specific objectives of that educational context (Al-Zahrani, 2022).

Fifth: Accompanying Activities:

- Accompanying activities play a significant role in achieving the educational objectives sought by society in nurturing the new generation through curriculum implementation. These objectives aim to strike a balance in various aspects of learners' growth, be it mental, physical, or psycho-motor. Thus, a balance is required between academic subjects, accompanying activities, and the activity itself has content, a plan to follow, and a goal to achieve. It requires evaluation to determine its success in reaching the intended goal. An activity can be educational when conducted by the teacher and learning-oriented when performed by the learner (Sabri & Raji, 2012: 30).

Sixth: Evaluation:

- Evaluation is an important element of the educational-learning program due to its ability to influence and be influenced by other elements of the program. Evaluation is the process that aims to determine whether learners have achieved the scientific educational program's objectives. In this context, evaluation is an integral part of the educational-learning program, while the evaluation of the educational program refers to assessing its suitability for learners and its ability to achieve educational objectives (Al-Jabri, Sabri & Raji, 2011: 84).

Secondly: Curry's Onion Model

Learning Styles: Understanding the learning styles of students, their preferences, and their awareness of these styles have a significant impact on the development of effective educational programs. It plays a crucial role in carefully selecting program components that provide optimal learning opportunities for various learning styles within the educational context. Therefore, several considerations should be taken into account:

Educators must be aware of their own learning styles and preferences.

It is important for learners to identify their own learning styles and which styles they prefer to use, even if they may not have a comprehensive understanding of these styles.

To determine the range of learning styles among learners, educators can employ a brief survey that can be completed in a short period, seeking responses from the learners.

Engaging in brief discussions between educators and learners can further elucidate the learning styles possessed by the latter and emphasize the importance of understanding these styles for effective learning.

Curry's Model: One of the well-known models for categorizing learning styles is Curry's model (Curry, 1983, 1987). Based on psychometric evidence and reviews of documented measures of learning styles, Curry (1983) developed a model consisting of nine scales to assess learning styles. These scales are organized into three layers resembling the layers of an onion. The core of Curry's onion model is the Internal Cognitive Style layer.

Curry's model comprises three main layers:

The Innermost Layer: Cognitive Personality Style

The Cognitive Personality Style is the central layer of Curry's Onion Model, focusing on an individual's capacity to acquire and assimilate information. This layer denotes a learner's style of comprehending and adapting information. It does not encompass interactions with the environment. Key personality traits that can influence learning include extraversion versus introversion, thinkers versus feelers, and judges versus perceivers. Curry's Onion Model is based on the research of Carl Jung, Katherine Myers, and Isabel Briggs Myers. Personal traits that may impact learning are extraversion versus introversion, thinking versus feeling, and judging versus perceiving (Munro, 2011, p. 23).

### The Middle Layer: Information Processing

The middle layer distinguishes between cognitive perceptual styles and information processing, which impact learning. Cognitive perceptual styles differentiate preferred methods for acquiring information, while information processing occurs through cognitive perceptual styles and cognitive strategies. This layer represents the middle section of Curry's Onion Model. Curry posits that cognitive perceptual styles are vital responses to the physical environment, indicating the primary way through which learners process information, whether it is visual, auditory, or kinesthetic. Cognitive perceptual differences affect what or how information is received, and learners do not utilize all their learning skills equally or perceive information uniformly. Cognitive processing styles refer to the thinking processes used to organize, structure, and retrieve perceived information (Bester, 2001, p. 22).

### The Outer Layer: Environmental Preferences

The outer layer of Curry's Onion Model represents the role of the environment and educational preferences in learning. This layer includes environmental preferences that influence learning.

## 3- Previous Studies

Study (Cools & Bellens, 2012):

Title of the Study: "Kari's Onion Model: Myth or Reality in the Field of Individual Differences?"

In order to clarify the conceptual framework concerning individual differences among learners, Kari (1983) devised a three-layered model known as the Onion Model. Two studies were conducted to address the research gap in the first study (N = 113). The analyses in the first study did not reveal a clear causal path among three concepts belonging to different layers regarding learning outcomes. In the second longitudinal study (N = 162), support for differences in stability between cognitive styles and study methods was not found (Cools & Bellens, 2012, p. 455-462).

Study (Rashtchi et al., 2019):

Title of the Study: "An Experimental Investigation into Kari's Onion Model: Does the Inner Personality Layer Predict the Outer Layers?"

Results of multiple regression analyses indicate significant relationships between the general configuration of patterns, revealing that the more stable inner cognitive patterns predict the nature of the less stable external learning patterns possessed by English as a Foreign Language learners (Rashtchi et al., 2019, p. 12).

## 4- Research Methodology and Procedures

The researcher adopted a descriptive approach for the stages of building an educational program based on Kari's model, along with an experimental research methodology to implement the educational program based on Kari's model for achieving educational outcomes in the subject of Educational Technology among third-year students at the College of Education.

Secondly, Research Procedures: Stages of Building the Educational Program

The researcher defined the stages of building the educational program following the steps of the ADDIE instructional design model, which includes a detailed breakdown of the procedures as follows:

The ADDIE Model for instructional design consists of five primary stages from which the model derives its name. These stages are as follows:

- A. Analysis
- B. Design
- C. Development
- D. Implementation
- E. Evaluation

(Zeinab Hamzah Raji et al., 2009, pp. 306-309).

In this section, the researcher discusses the characteristics of the students and their needs, as well as the steps taken in the research methodology.

#### A. Characteristics of the Students:

The researcher identified the characteristics of the research sample as follows:

1. The age of the students in the research sample ranged between 20 and 21 years.
2. The research sample included both male and female students.
3. The research sample came from a homogeneous social environment.
4. The students in the research sample exhibited homogeneity in their prior knowledge of Educational Technology and their intelligence, as indicated by the results of equivalence tests conducted on the sample.

#### B. Students' Needs from Their Perspective:

The researcher identified the needs of the students as follows:

1. The researcher prepared a questionnaire directed at a group of fourth-year students who had previously studied Educational Technology in the preceding year. The total number of respondents was 35 students, both male and female. The questionnaire contained a single question: "What difficulties did you encounter while studying Educational Technology in the third year?"

#### C. Identifying Needs from the Perspective of Teaching Faculty:

The researcher identified the needs as follows:

1. The researcher prepared a questionnaire directed at a group of Educational Technology faculty members at the College of Education, totaling 10 teaching staff members. The questionnaire contained a single question: "What difficulties did you encounter while teaching Educational Technology in the third year at the College of Education?"

#### D. Defining General Objectives of the Educational Program:

The researcher derived objectives for the educational program, taking into account the content of the subject matter, the research objectives, as well as the characteristics and needs of the students. These objectives align with the general objectives of teaching Educational Technology for third-year students at the College of Education, as approved by the Dean's Committee in the Republic of Iraq.

#### E. Design - Determining and Organizing the Educational Program Content:

In this research, educational content refers to a collection of information, facts, concepts, principles, theories, laws, forms, educational activities, and illustrations. The researcher examined the terminology used by the sectoral committee for Educational Sciences regarding the content of Educational Technology for third-year students at Colleges of Education. The educational content for the program was determined based on the nature



of the objectives, behavioral objectives, the characteristics and needs of the students, as well as the nature of the subject matter.

In the development phase of the research, the following steps were taken:

#### F. Formulating Behavioral Objectives:

The researcher crafted a total of 114 behavioral objectives for the subjects covered in the Educational Technology course for third-year students. These objectives were developed while considering the nature of the subject, its general goals, the characteristics of the students, and their specific needs. They were categorized according to Bloom's taxonomy, encompassing its six levels: knowledge, comprehension, application, analysis, synthesis, and evaluation. To ensure their validity and comprehensiveness in addressing the subject matter, they were reviewed by a group of specialized evaluators.

#### G. Determining Teaching Models and Strategies:

The researcher adopted several teaching models and corresponding strategies, including those in alignment with Kari's model. These models and strategies have been validated in educational literature and previous studies. They were chosen after review by experts in curriculum and teaching methods to identify the most suitable ones for the content of Educational Technology for third-year students, with the aim of facilitating the achievement of the intended educational objectives.

#### H. Preparing Educational Activities:

A variety of educational activities were developed for each lesson within the program. These activities were designed to promote active engagement between theoretical and practical aspects of learning, enhancing comprehension of the educational material and fostering effective perception. (Ameen, L. T. (2022)

**Educational Technology:** The researcher utilized a set of appropriate educational technology tools and techniques in the educational program, considering the desired objectives, the nature of the subject matter, and the characteristics of the research sample.

**Implementation:** The researcher prepared an instructional lesson from one of the program's topics and applied it to a group of students to assess the clarity of objectives, the clarity of the presented material, and the extent of student engagement according to Kari's model.

**Assessment:** Based on these criteria, two assessment methods were adopted in the educational program: formative assessment and summative assessment, as follows:

##### A. Formative Assessment:

The researcher employed formative assessment through various methods, including oral questions, dialogues between the researcher and students during teaching, daily and monthly tests, student activities, and self-assessment questions included in each lesson of the educational program.

##### B. Summative Assessment:

For summative assessment, the researcher applied achievement tests to the research sample after the completion of the educational program.

##### C. Validity of the Educational Program:

After completing the construction of the educational program, the researcher ensured its validity by presenting it to a group of specialized evaluators in the field of educational and psychological sciences.

Secondly: Effectiveness of the Educational Program:

1. Experimental Approach: The researcher followed an experimental approach to assess the effectiveness of the educational program.
2. Experimental Design: The researcher adopted a partial control group experimental design with a posttest for achievement. This design was chosen because the researcher selected the research sample in the form of classroom groups in the third year, pre-determined by the Department of Psychology, without any intervention in their distribution.

Two groups	Independent variable	Dependent variable	Dimensional test
Experimental section A	Educational system	achievement	achievement test
Controllable section B	—		

Experimental design

Third: Research Population and Sample

A. Research Population: The current research population consists of third-year students in the Department of Psychology at the College of Education, Wasit University, during the academic year 2022-2023.

B. Research Sample: The researcher is a faculty member at the College of Education, Wasit University, based on a facilitation letter issued by the Graduate Studies at the College of Education (Ibn Rushd) for Humanities and Social Sciences, University of Baghdad. According to the experimental design adopted in the current research, the researcher used random sampling to select the experimental group. Classroom (A) represented the experimental group, which was taught the Educational Technology course within the educational program, while classroom (B) represented the control group, which was taught the same course using traditional methods. The current research sample comprised a total of 94 male and female students from the Department of Psychology, with 46 students in the experimental group and 48 students in the control group.

Fourth: Equivalence of the Research Groups

Table 1: Results of the One-Tailed T-Test for the Ages of the Students in the Research

Group	Sample members	arithmetic mean	Standard deviation	Freedom degree	T values		Significance rate 0,05
					counted	tabular	
experimental	46	19.9783	.829700	92	.2450	1.98	Not significant
controllable	48	19.9375	.782960				

Table 2: Results of the One-Sample T-Test for the Intelligence Variable Among the Research Group's Students.

Group	Sample members	arithmetic mean	Standard deviation	Freedom degree	The two values		Significance rate 0,05
					counted	tabular	
experimental	46	26.1522	2.54705	92	.6880	1.98	Not significant
controllable	48	25.7917	2.53451				

Table 3: Results of the One-Sample T-Test for the Preexisting Knowledge Variable Among the Research Group's Students

Group	Sample members	arithmetic mean	Standard deviation	Freedom degree	The two values		Significance rate 0,05
					counted	tabular	
experimental	46	17.0870	1.44262	92	1.044	1.98	Not significance
controllable	48	16.7708	1.49096				

#### Research Components:

##### Preparation of the Teaching Guide:

The researcher has prepared (30) exemplary lessons for teaching students in the experimental group based on the strategies included in the educational program, and their models are included in the teaching guide. Additionally, a set of teaching plans has been prepared for the control group, following the traditional method, totaling (30) plans for each group.

##### Research Instrument: The Achievement Test:

To assess the impact of the educational program on the acquisition of knowledge in the subject of Educational Technology by third-year students at the College of Education, achievement is considered a measure of learning outcomes and an indicator of a student's progression from one level to another (Raji, 2016:164). The researcher designed an achievement test consisting of two parts: the first is an objective test comprising (40) objective items to measure learning outcomes, and the second is an essay test consisting of (10) items.

##### Development of Specifications Table:

To achieve this, the researcher prepared a specifications table for the topics of the Educational Technology subject, relying on the number of behavioral objectives and their relative importance in light of Bloom's six levels of the cognitive domain classification.

##### Formulation of Test Items:

The researcher used multiple-choice objective items in formulating the achievement test (with four alternatives) and employed specific answer essay-type questions in formulating the achievement test items, which assess levels of analysis, synthesis, and evaluation. Thus, the total number of achievement test items is (50), including (40) objective items of the multiple-choice type and (10) essay-type items. The score for objective items was (40), while the score for essay items was (30), resulting in a total test score of (70).

##### Test Validity:

The test's validity was established through the following methods:

##### a. Face Validity:

The researcher presented the achievement test to a group of experts specializing in teaching methods, assessment, and evaluation to solicit their opinions and feedback regarding its validity and formulation. Necessary modifications were made to some items in light of their feedback.

##### b. Statistical Validity:

To ensure statistical significance, the chi-squared ( $\chi^2$ ) test was employed. The results indicated statistically significant differences, as the calculated  $\chi^2$  value exceeded the

tabulated value at a significance level of (0.05). Consequently, all items were considered valid for measuring the intended purpose for which they were designed (Soliman, 2023).

#### Content Validity:

The content validity was verified through the specifications table.

#### Pilot Testing of Clarity of Items and Instructions:

The researcher administered the achievement test to a sample of (20) students from the History Department to assess the clarity of the test items and instructions. The average time taken to complete the test was calculated and found to be (50) minutes. It was determined that all test items and instructions were clear and comprehensible.

#### Statistical Analysis of Test Items:

The test was administered to a sample of (100) students from the History Department at the College of Education, representing the research population. After scoring the responses, the researcher ranked the students' scores in descending order. Subsequently, the researcher selected the top and bottom extreme 27% of students. Each of the two selected groups consisted of (27) students, both male and female.

##### a. Item Difficulty Index:

After calculating the item difficulty index for each item in the achievement test, it was found to range between (0.46-0.57) for objective items and between (0.46-0.53) for essay items (Abbas & Muhammad & Khalid, 2022).

##### b. Discrimination Power of Items:

After calculating the discrimination power coefficient for each item in the achievement test, it was found to range between (0.93-0.70) for objective items and between (0.34-0.64) for essay items. This indicates that all test items are good and suitable for application.

##### c. Effectiveness of Distractors:

Upon calculating the effectiveness of distractors, negative values were found.

##### d. Test Reliability:

To calculate the reliability coefficient of the achievement test, the researcher randomly selected (50) test sheets from the statistical analysis sample. The Cronbach's alpha coefficient was used, as it is an indicator of the consistency of the score for each item in the test. After data processing, the reliability coefficient was found to be (0.80) for the objective items, which is considered good.

#### Reliability of Essay Item Scoring:

##### 1. Scorer Reliability:

To score the essay items, the researcher corrected (50) answer sheets for the (10) essay questions. After using the Pearson correlation coefficient, the reliability coefficient of the essay questions was calculated.

##### 2. Reliability with Another Scorer:

The researcher, to confirm the reliability of scoring, reached an agreement with the subject matter expert to score the essay questions after being trained on scoring a sample of reliability. When using the Pearson correlation coefficient between the researcher and the subject matter expert, the reliability coefficient was found to be very good.

### Implementation of the Program (Experiment):

The researcher personally commenced teaching both research groups on Tuesday, October 4, 2022, conducting two lectures per week for each group, and concluded on Monday, May 29, 2023.

### Statistical Methods:

To process the data and extract the results, the researcher used the (SPSS) software and Microsoft Excel for the following statistical methods: Independent Samples T-test, Chi-Square ( $\chi^2$ ) test, item difficulty coefficient for objective items, discrimination power coefficient for objective items, effectiveness of distractors equation, item difficulty coefficient for essay items, item difficulty coefficient for essay items, Cronbach's alpha coefficient, Pearson correlation coefficient, Eta-squared.

## 5- Research Results and Their Interpretation

### First: Presentation of Results

After administering the achievement test and obtaining the scores of the research group students, the following statistical methods were used to verify the null hypothesis, as illustrated in Table 4:

Table 4: One-Sample T-Test Results for the Post-test Scores of the Research Groups

Group	num ber	arithmetic mean	Standard deviation	Freedom degree	The accounted T value	The tabular accounted value	Significance rate	result
experimental	46	60.2826	5.63191	92	12.896	1.98	0.05	Signific ance
controllable	48	38.3333	10.14015					

### Interpretation of Results and Discussion:

#### 1. Presentation of Results:

From the table above, it is evident that the average scores of the experimental group students in the achievement test were (60.2826), with a standard deviation of (5.63191). In contrast, the average scores of the control group students were (38.3333), with a standard deviation of (10.14015). Using the independent samples t-test, it was revealed that the calculated t-value (12.896) is greater than the critical t-value (1.98) at a significance level of (0.05) with degrees of freedom (92). This indicates that there is a statistically significant difference in favor of the experimental group, which was taught using the instructional program based on the Carey model. Consequently, the null hypothesis is rejected.

#### Effectiveness of the Carey Model:

The effectiveness of the instructional program based on the Carey model is measured by assessing the effect size between two independent groups in achievement, as well as determining whether this difference has statistical significance. To measure the effect size of the independent variable (instructional program based on the Carey model) on achievement, the researcher used Cohen's d formula, yielding a value of (2.676137) for achievement. This is considered a very high effect size according to Cohen's classification.

#### 2. Interpretation of Results and Discussion:

The results indicate the superiority of the students in the experimental group who learned according to the instructional program based on the Carey model (Curry, 1983) over the control group. The researcher attributed this improvement in achievement to a set of

interacting factors that contributed to enhancing student performance. These factors include:

1. **Organization and Efficiency:** The use of the Carey model in the instructional program helps in organizing lessons effectively, eliminating improvisation, and maximizing the use of time. It ensures that lesson planning and execution are well-structured, leading to an ideal learning experience for students.
2. **Rich Learning Environment:** Implementing the Carey model helps create an information-rich and resourceful learning environment that greatly benefits students. By analyzing the classroom environment, considering students' characteristics and needs, and aligning the study materials with the overall objectives, the model facilitates the development of appropriate teaching strategies.
3. **Curriculum Alignment:** The Carey model emphasizes the reorganization of study materials and identification of relevant learning resources. This ensures the delivery of content that aligns with students' age and developmental stage, enhancing overall effective learning.
4. **Individualized Learning:** The researcher found that the Carey model accommodates students' specific needs, leading to increased participation and a sense of pride in their work. This fosters healthy competition among students and motivates them to excel.
5. **Alignment with Cognitive Processes:** The Carey model closely aligns with students' cognitive processes, learning preferences, and learning styles. As a result, students' interest and engagement during lessons increased, and they developed a stronger desire to learn the subjects.

In conclusion, the researcher found that the instructional program based on the Carey model had a positive impact on student achievement, fostering a rich and engaging learning environment that catered to individual needs. The model not only improved academic performance but also motivated students to excel. It was noted that the Carey model resonated well with students, aligning closely with their thinking processes and learning preferences. (Majda & Dawood Abdul Salam, 2021)

Thirdly: Conclusions:

Based on the research findings, the researcher can conclude the following:

1. The instructional program led to an improvement in academic performance and increased levels of achievement among students.
2. The model provides a framework and guidelines for designing effective teaching plans, ensuring the organization, suitability, and alignment of content with curriculum objectives.

Fourthly: Recommendations:

Building on the results, the following recommendations can be made:

1. The instructional program based on the Carey model should continue and be expanded to reach a broader range of students and subjects.
2. Teachers should receive adequate training and professional development opportunities for the effective implementation of the Carey model in their lectures.

Fifthly: Suggestions:

In light of the above and as a continuation of the current research, the researcher suggests the following:

1. Investigating the impact of the Carey model on conceptual understanding in educational technology.

2. Assessing the effectiveness of the Carey model in enhancing student achievement in education colleges and their mastery of learning objectives.

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