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# Designing An Educational Package Based On Artificial Intelligence And Statistical Techniques

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***Abstract***
*This study aims to evaluate the effectiveness of designing an educational package based on artificial intelligence and statistical techniques in developing scientific research skills among students at the College of Basic Education. The researcher adopted a quasi-experimental approach with two equivalent groups, implementing pre-tests and post-tests. The sample consisted of 105 randomly selected students from the Mathematics Department, out of a total of 863 students enrolled in the college during the 2024–2025 academic year.*
*The researcher developed a multiple-choice test comprising 30 items to assess scientific research skills. Various statistical tools were employed, including percentage ratios, chi-square tests, correlation coefficients, and t-tests for independent and dependent samples.*
*The results indicated statistically significant differences in favor of the experimental group after applying the educational package, with no gender-based variations. The researcher concluded that the designed package had a positive impact on enhancing scientific research skills. Accordingly, it was recommended that artificial intelligence and statistical techniques be integrated into curriculum design for improved learning*
***Keywords***: *Designing Educational Package; Artificial Intelligence; Statistical. Introduction*

**Research Problem:**
The research problem centers on the growing need to enhance scientific research skills among university students, particularly in Colleges of Basic Education. While artificial intelligence and statistical techniques offer vast potential for improving educational practices, their use in designing instructional packages remains limited. This study addresses the effectiveness of such a package in fostering essential research skills. The behavior and interactions. Therefore, paying attention to the emotional side of their lives is extremely important. The current lies in students' ability to formulate research problems, analyze data, and apply modern tools. The study seeks to determine whether an AI- and statistics-based learning approach can bridge this gap. Thus, the central question is: *How effective is an educational package based on AI and statistics in developing research skills*

**1.2. Research Hypotheses:**
1. There is no statistically significant difference at a significance level of (0.05) between the mean scores of the experimental group in the pre-test and post-test of scientific research skills.
2. There is no statistically significant difference at a significance level of (0.05) between the difference in mean scores of the experimental group in the pre-test and post-test of scientific research skills and the mean scores of the control group in the same tests.

**1.3. Research Aims**
The current research aims to examine the effectiveness of designing an educational package based on artificial intelligence and statistical techniques in developing scientific research skills among students at the College of Basic Education.

**1.4. The educational package**
is a structured instructional program designed to provide learners with a variety of materials, activities,

and educational experiences that help them acquire reading, writing, and arithmetic skills in an easy, enjoyable, and efficient manner. It is tailored to suit the learner's abilities, characteristics, interests, and learning style, with the goal of achieving specific, pre-planned educational objectives [1].

**1.5 Artificial intelligence**

is defined as *"the ability of machines and systems to acquire and apply knowledge, and to simulate intelligent behavior."* It requires AI to perform tasks typically carried out by humans, such as sensing, reasoning, learning, and decision-making. AI systems utilize a combination of specialized algorithms and may also rely on other technologies like big data analytics, which enables them to remain in a state of continuous learning [2].

**1.6Statistics**

is a set of scientific methods concerned with the collection, classification, tabulation, interpretation, summarization, and evaluation of data. It aims to draw conclusions about a population by relying on a small part of it—the sample. [3].

**2. Materials and methods**

**Research Methodology:**

The researcher adopted an experimental approach using quasi-experimental designs, involving two equivalent groups with pre-tests and post-tests.

**Research Population:**

The study targeted fourth-year students at the College of Basic Education, University of Misan, during the academic year (2024–2025), totaling 863 students.

**Research Sample:**

A random sample of **32** students from the Mathematics Department was selected for the study.

The researcher utilized the **Scientific Research Skills Test** to enhance research skills among students at the College of Basic Education.

**Research Tool**

A test consisting of 30 items was developed based on pre-defined research skills. The researcher ensured that the test items were objective, adopting a multiple-choice format with four alternatives, as this type is characterized by comprehensiveness and relies on a high degree of validity and reliability. [4].

1- **Face Validity**: The test was presented to a group of experts (Appendix 9) to assess the validity of the items and their coverage of the subject matter. As a result, the test was finalized while maintaining a fixed number of items [5].

**Table 1**. Statistical significance of face validity for the items in the scientific research skills test

| Statistical significance | Chi-Square Value | | Disagree | | Agree | | Items |
|---|---|---|---|---|---|---|---|
| | Tabulated Chi-Square Value | Calculated Chi-Square Value | Frequency | Frequency | Frequency | Frequency | |
| Statistical significance | 3.84 | 20 | 0% | 0 | 100% | 20 | 1.2.3.4.5.6.8.12.15.16.17 18.20.21.22.23.28.29.30 |
| Statistical significance | | 7.200 | 20% | 4 | 80% | 16 | 7.9.10.11.13.14.19 24.25.26.27 |

**Exploratory Application:**

The researcher administered the test on **Wednesday, October 9, 2024**, to a **randomly selected sample** of **100 male and female students** from the **Science Department** at the **College of Basic Education**, drawn from the research population[6].

The researcher calculated the total score for each test and ranked them from highest to lowest. Then, the top **27%** of the scores were identified as the **upper group**, consisting of **27 participants**, while the bottom **27%** were classified as the **lower group**, also comprising **27 participants**. The total number of individuals in both groups was **54**. Subsequently, the test items were analyzed as follows: [7].

**Difficulty Index:**

Upon calculating the **difficulty index** for each test item, it was found to range between **0.2115 and 0.6713**, indicating that all test items are **well-constructed** and have an **appropriate difficulty level**[8].

**Discrimination Index:**

After applying the item-specific formula to calculate discrimination power, it was found that all items had a discrimination index ranging between 0.213 and 0.757. As a result, the researcher retained all items without any deletions. [9].

**Effectiveness of Incorrect Alternatives:**

Upon calculating the effectiveness of incorrect alternatives, it was found that all items had **negative values**, indicating that these alternatives attracted **more students from the lower group than from the upper group**. Based on this finding, the researcher decided to **retain the incorrect alternatives without modification** [10].

**Test Reliability:**

Reliability was calculated using the **split-half method**, where Pearson's correlation coefficient was found to be **0.864**. After applying the **Spearman-Brown correction**, the reliability value increased to **0.927**. This high value indicates that the test possesses [11].

## 3. RESULTS

### 3.1. First Null Hypothesis:

The hypothesis states that there is no statistically significant difference at the 0.05 significance level between the mean scores of the experimental group in the pre-test and post-test of scientific research skills. After completing the experiment and administering the post-test to the research sample of the experimental group, the paired t-test for two dependent samples of equal size was used to verify the research hypothesis. The statistical analysis was conducted using the SPSS package.

**Results Analysis:**

The findings indicate a **statistically significant difference** at the **0.05 significance level** with **30 degrees of freedom** between the **mean scores** of the **experimental group** in the **pre-test and post-test**, favoring the **post-test**.

- The **mean score** of the experimental group in the **pre-test** was **9.5**, with a **standard deviation** of **2.366**.
- The **mean score** in the **post-test** increased to **21.5**, with a **standard deviation** of **2.47**.
- The **calculated t-value** was **16.423**, which is **higher** than the **tabulated t-value** of **1.69**.

This confirms a **statistically significant difference**, favoring the **experimental group in the post-test**. As a result, the **null hypothesis was rejected**, and the **alternative hypothesis was accepted**, indicating that **students in the experimental group outperformed themselves in the post-test of scientific research skills**.

### 3.2. Second Null Hypothesis:

The hypothesis states that there is no statistically significant difference at the 0.05 significance level between the difference in mean scores of the experimental group in the pre-test and post-test and the

mean scores of the control group in the pre-test and post-test of scientific research skills.

After completing the experiment and administering the pre-test and post-test to the research sample of both the experimental and control groups, the independent samples t-test was used to verify the research hypothesis. The statistical analysis was conducted using the SPSS package.

**Results Analysis:**

The findings indicate a **statistically significant difference** at the **0.05 significance level** with **30 degrees of freedom** between the **mean difference in scores** of the **experimental group** in the **pre-test and post-test** and the **mean difference in scores** of the **control group** in the **pre-test and post-test**, favoring the **experimental group**.

- The **mean score** of the experimental group was **12**, with a **standard deviation** of **3.403**.
- The **mean score** of the control group was **9.375**, with a **standard deviation** of **2.291**.
- The **calculated t-value** was **2.2**, which is **higher** than the **tabulated t-value** of **1.69**.

**4. Interpretation of Results:**

1. This confirms a **statistically significant difference**, favoring the **experimental group** in the **pre-test and post-test comparison**. As a result, the **null hypothesis was rejected**, and the **alternative hypothesis was accepted**, indicating that **students in the experimental group outperformed those in the control group in the scientific research skills test**.

**Interpretation of the First Null Hypothesis Results:**

The results showed a **statistically significant difference** between the **pre-test and post-test** of scientific research skills among students in the **experimental group**, favoring the **post-test**.

This difference can be attributed to the **use of artificial intelligence and statistical techniques** in designing the learning package, which positively impacted students' scientific research skills through:

1. **Stimulating Effective Learning:** AI techniques provide a personalized learning experience tailored to each student's needs, enhancing their deep understanding.
2. **Practical Application of Statistics:** Incorporating statistics in the package enables students to systematically handle data and analyze it accurately, which is essential for improving scientific research skills.
3. **Interactivity and Engagement:** Technology makes the learning process more engaging and interactive, encouraging students to participate and immerse themselves in learning.
4. **Developing Critical Thinking:** Exposure to these advanced tools drives students to think critically and systematically, thereby improving their performance in scientific research skills.

2. **Interpretation of the Second Null Hypothesis Results:**

The results showed a **statistically significant difference** between the **mean scores** of the **experimental and control groups** in the **pre-test and post-test** of scientific research skills, favoring the **experimental group**.

This difference can be attributed to the **use of artificial intelligence and statistical techniques** in designing the learning package (Appendix 11), which positively impacted students' scientific research skills through:

1. **Enhancing research abilities and scientific thinking:** AI techniques contribute to improving students' research capabilities and scientific reasoning, enabling them to **collect, analyze, and interpret data systematically and accurately**, thereby increasing the precision of their scientific studies.
2. **Promoting self-directed learning:** The educational package allows students to **track their progress individually** and work at their own pace, fostering **independence and confidence** in conducting research.
3. **Encouraging innovation and creativity:** The integration of AI and statistics provides students with opportunities to **apply innovative ideas** and use **advanced techniques** for data analysis, enhancing their **creative thinking**.

4. **Practical application of research skills:** The package may have included **case studies and practical examples**, helping students **practice scientific research skills in a hands-on manner**, making them **better prepared for real-world applications**.
5. **Developing collaboration skills:** If the package included **collaborative activities**, it likely contributed to **improving teamwork skills**, which are essential in research environments.
6. **Interaction with advanced technology:** The experience of using the package prepares students to **face future challenges** in research and education, which increasingly rely on technology.
7. **Personalized and guided learning:** AI enables the **customization of content** to align with students' individual needs, enhancing their ability to **learn and acquire skills effectively**.
8. **Scientific use of data:** The statistical integration within the package provides a **clear methodology for organizing and presenting data**, supporting students in **developing their ability to work with numbers and research reports**.
9.

## CONCLUSIONS

Based on the results obtained in this study, the researcher reached the following conclusions:

1. **Development of Scientific Research Skills:** The educational package, designed using **artificial intelligence and statistical techniques**, significantly contributed to the development of **scientific research skills** among students at the **College of Basic Education**. By providing **interactive and data-driven educational content**, the package created an **advanced learning environment** that combines **statistical accuracy and AI-driven insights**, fostering **critical thinking** and enhancing students' ability to conduct **independent and structured research**.
2. **Increased Engagement and Interest in Research:** Students showed **greater interest** in the **scientific research process** and actively participated in research activities designed using **AI and statistical techniques**, leading to **improved comprehension levels**.
3. **Enhanced Accuracy and Effectiveness:** The results demonstrated that the **AI-driven educational package** was **more precise and effective** in achieving the desired learning outcomes compared to **traditional research writing methods**.
4. **Development of Critical and Analytical Thinking Skills:** The package helped students **develop critical and analytical thinking** by providing **tasks and activities** that required **research and analysis**. These activities included **practical applications and real-world examples**, encouraging students to **engage deeply with topics**, thereby strengthening their **critical thinking and evaluation skills**.
5. **Increased Motivation for Learning:** The study observed that students **became more enthusiastic** about **research and exploration** due to the **integration of modern technologies** in research writing.
6. **Time and Effort Efficiency:** Although the **initial development** of the AI-driven educational package required **significant time and effort**, the results proved that the package was **highly effective** and contributed to **saving time and effort** in research writing over the long term.
7.

## RECOMMENDATIONS

Based on the study's conclusions, the researcher recommends the following:

1. **Adopting AI and Statistical Techniques in Teaching:** It is essential to **integrate AI and statistical techniques** in designing and implementing **educational packages** to **facilitate learning** and **increase its effectiveness**.
2. **Developing a Guide for Educators:** A **comprehensive guide** should be prepared to **explain how AI and statistical techniques** can be used in **educational package design**, including **detailed implementation steps and practical examples**.
3. **Conducting Training Workshops for Educators:** It is crucial to **organize training workshops** for educators on **how to use AI and statistical techniques** in education, highlighting their **potential benefits** in **enhancing students' scientific research skills**.
4. **Encouraging the Use of Modern Technologies in Education:** The study recommends **promoting the use of modern technologies** in education to **increase student engagement** and **interest in scientific**

**research**, thereby **developing their research and intellectual skills**.

5. **Creating an Innovative Learning Environment:** The study emphasizes the **need to develop an innovative learning environment** that supports **modern technologies** and provides students with **opportunities for interaction, exploration, and reasoning through scientific research**.
6. **Monitoring and Evaluating Effectiveness:** It is necessary to **continuously monitor and evaluate** the effectiveness of **AI-driven educational packages** through **ongoing studies and research** to assess their **impact on students' scientific research skills**.

**Suggestions for Future Research**

To expand on the current study, the researcher suggests the following:

1. **Conducting a similar study** to evaluate the effectiveness of **AI-driven educational packages** in teaching other subjects such as **research methodology, statistics, and computing**.
2. **Exploring the impact of AI-driven educational packages** on other dependent variables such as **decision-making, lateral thinking, motivation, reflective thinking, holistic thinking, and academic achievement**.
3. **Investigating the effectiveness of AI-driven educational packages** in **enhancing scientific research skills** among **graduate students**.
4. **Comparing AI-driven educational packages** with other **teaching strategies**, such as **project-based learning and interactive learning**, to determine their **effectiveness in developing students' scientific research skills**.

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