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EFFECTIVENESS OF DIFFERENTIATED INSTRUCTION USING ARTIFICIAL INTELLIGENCE ON THE ACHIEVEMENT IN MATHEMATICS

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Abstract:

The swift expansion of artificial intelligence has aided educators worldwide in creating the best possible learning environments that cater to the various learning preferences of their students. This study set out to ascertain and quantify the impact of AI-powered differentiated instruction on seventh-grade math achievement at Raja Shiv Chatrapati English Medium School in Talawade, Pune. The impacts of AI-powered differentiated education on students' mathematical achievement were investigated by the researcher using an experimental approach. The study consisted of 44 students in the experimental group with differentiated instruction using AI integration. Taking into consideration the ICT sustainability of the school, only one unit of mathematics was created and implemented using differentiated instruction lesson plan with AI integration. Moreover, the researcher used mean and standard deviation to analyze the data. The findings showed that AI-powered differentiated instruction significantly raises student respondents' achievement. Based on the results, it was recommended that teachers should be given priority by offering worthwhile professional development courses about integrating AI and teaching differently in every subject.

Keywords: *Differentiated Instruction, Achievement, Artificial Intelligence, Learning Preferences, Professional Development Program.*

Introduction:

This study investigates the use of artificial intelligence (AI) in education, a relatively new and quickly developing field. This branch of computer science is concern with building intelligent devices that can perform operations which require human intelligence. And these operations are object recognition, language comprehension and speech, decision-making, and interlanguage translation. AI aims to build machines that can learn on their own and improve their problem-solving skills over time. There are numerous researches which tells that the use of AI in education enhance the quality of teaching and learning. For instance, Seo et al. (2021) reported that AI systems provide significant assistance in online education, promotes personalized student learning experiences, efficiently organized routine tasks for instructors, and enabling adaptive evaluations. Also, research by Kim and Kim (2023) concluded that a majority of STEM educators have had positive experiences with AI, particularly in its role as an advanced support mechanism for learning. It is important to understand how the evolution of AI can be effectively integrated into various educational contexts, including differentiated instruction classrooms (Johler & Krumsvik, 2022). AI integration in education supports individualized learning by allowing lesson content to be tailored to each student's needs, resulting in a more advantageous and significant learning environment.

Hence objective of this study is to assess the effectiveness of Artificial Intelligence on students' achievement in differentiated classroom.

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Theoretical Background:

The theories of Maslow, Vygotsky, Gardner, Sternberg, and Tomlinson are all incorporated into the concept of differentiated education. According to Maslow's hierarchy of needs, kids will learn if their basic wants are satisfied (Maslow, 1987). A student will advance to the next level after these needs are met. Vygotsky (2004) emphasized that in order for pupils to acquire knowledge, they must be challenged. Both Gardner's (1993) theory of multiple intelligences and Sternberg's (Sternberg and Williams, 2002) theory of thinking styles discuss how people learn and process information. Based on these theorists, Tomlinson (2003) asserts that differentiated instruction is responsive instruction that modifies the process, content, and final product for every student. Differentiated instruction was and is best conceptualized as a teacher's response to the diverse learning needs of students in the general education classes (Tomlinson, 2010; 1999; Tomlinson & McTighe, 2006).

Need & Significance:

Students learn at different speeds and they differ widely in their ability to think abstractly or understand (Tomlinson,1998). Different students prefer different learning environments, learning modalities and they all exhibit unique strengths or weaknesses (Chitkara, 1985). Differentiated instruction must therefore be developed and put into practice in the classroom. However, implementing differentiated instruction presents many challenges, such as identifying a student's zone of proximal development, having deep domain knowledge to differentiate, flexible grouping, a continuous cycle of evaluating needs, planning and delivering instruction around those needs, and reevaluating progress to restart the cycle. Because technology tools are characterized by interaction, accessibility, accommodation, and adaptation of material and educational learning settings, artificial intelligence (AI) can assist ease some of the strain associated with differentiated instruction. AI also helps teachers modify their lessons to fit the interests, learning styles, and readiness levels of their pupils.

Statement of Problem:

To study the Effectiveness of Differentiated Instruction using Artificial Intelligence on Academic achievement in Mathematics of VII standard students studying in Raja Shiv Chatrapati English medium school following Maharashtra State Board syllabus in Pune city.

Operational Definitions:

DIFFERENTIATED INSTRUCTION refers to the instructional program that will be developed by the researcher for VII standard English medium students. This program will include pre-assessment of the learner's need, designing of learning experiences and tasks using Artificial Intelligence and then implementation of lesson sequence.

VII STANDARD STUDENT: VII standard student refers to the students belonging to the age group of 11-12 years and studying Mathematics from **Raja Shiv Chatrapati English medium school** following Maharashtra State Board syllabus in Pune city.

ACHIEVEMENT IN MATHEMATICS refers to the effects of learning 'Angles and Types of Angle' that will be identified from the scores obtained on Unit Standardized Achievement Test in Mathematics prepared on the topic "Angles and Types of Angle" of class VII textbook of Maharashtra Board.

Objectives of the Study:

1. To analyze the content of standard VII Mathematics textbook
2. To plan differentiated instructional strategies using AI.
3. To study the effectiveness of the Differentiated Instruction using AI on the achievement in Mathematics of grade VII students.

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Null Hypothesis:

There is no significant effect of the Differentiated Instruction using AI in Mathematics teaching on the achievements of grade VII students.

Assumptions:

1) Differentiated instruction is effective on academic achievement. (Varghese, S. (2010))
2) The AI tools have potential to enhance teaching and learning outcomes. (Ruslim, M.I. and Khalid, F. (2024))
3) Teachers consider ICT tools suitable for meeting all students' learning needs and styles. (Karatza, Z. (2019))

Limitations of the Study:

1. The present study was limited to Pune City.
2. The present study was limited to only one school of Pune City.
3. In the present study, only 44 students were included.

Methodology:

Method adopted for the study

The experimental method was found to be the most appropriate for the present study.

Research Design:

The design selected was one group pretest-posttest design.

Sampling Procedure:

Purposive sampling was carried out for the collection of data. The present study made use of one intact classroom group called an experimental group which consisted of 44 students. This study was conducted in one division of standard VIIof Raja Shiv Chatrapati English Medium School, Pune, Maharashtra.

Variables Used for the Study:

Independent Variable: In present study independent variable was Differentiated Instruction Using AI. Independent Variables are those conditions or characteristics that an experimenter manipulates or controls.

Dependent Variable. In the present study dependent variable was achievement in Mathematics of VIIgrade students. These variables are those which change as the experimenter introduces, changes or removes independent variables.

Control Variables. Controlled variables were the grade, age, number of lectures, selection of unit and subject. These types of variables are characteristics which can be controlled by investigator during experiment.

Extraneous Variables: In this present study extraneous variable was Scores of VI standard exam.

Tools Used for the Study:

Achievement Test in Mathematics

Statistical Techniques Used :

Mean

Standard Deviation

Findings of the Study:

Test	N	Mean	S.D.
Pre-Test	44	33.89	6.47
Post-Test	44	42.86	3.25

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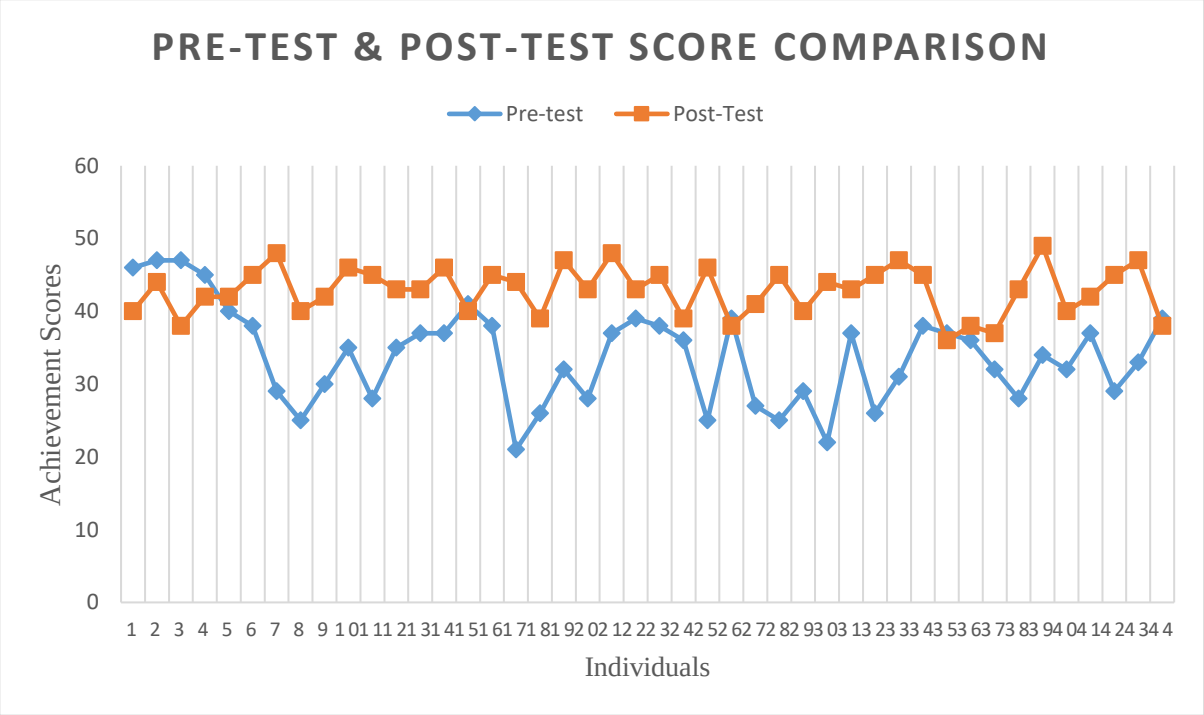

Graphical Representation of Achievement Scores in Pre & Post Test

Analysis and Interpretation:

From the above table and graph, it can be seen that the mean score of the post-test conducted after the implementation of differentiated instruction using AI is higher than the mean score of the pre-test conducted before the implementation of differentiated instruction using AI. Mean scores of pre & post tests are 33.89 & 42.86 respectively. There is significant difference between the mean achievement score of Pretest administered before the Differentiated Instruction using AI and Posttest administered after the Differentiated Instruction Using AI. It reveals that the Differentiated Instruction Using AI is capable of increasing achievement in mathematics.

Results and discussion :

The rapid growth in the use of AI technology have provided an avenue for teachers across subject areas to look into the most suitable learning experiences that would accommodate learners' different learning styles. The purpose of this study was to determine and measure the effectiveness of differentiated instruction in teaching Mathematics using Artificial Intelligence tools in learners' mathematics achievement among Grade VII in Raja Shiv Chatrapati English Medium School, Pune, Maharashtra. As per the findings it is revealed that differentiated instruction using AI has a great impact on the achievement in Mathematics.

Educational Implications:

- Differentiated Instruction using Artificial Intelligence, can be used to enhance the achievement of the students.
- Teachers must be trained to use a Differentiated Instruction and Artificial Intelligence in the classroom. This training will definitely improve the teaching-learning process and thus the achievement of students.
- The training curriculum must be modified and Differentiated Instruction using AI must be given place so that student teachers will get trained to use Differentiated Instructional strategies using AI in the actual classroom.

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