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The Power Of Experience: Rewriting Students' Mathematical Perceptions

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Abstract: **-** Students' perception toward Mathematics subjects has been a major concern in Mathematics education research. Ma and Kishor (1997) suggested that students dislike Mathematics as they have developed negative attitudes and have a perception that it is a difficult subject compared to any other subject (Rodríguez et al., 2020), as this subject evokes feelings of stress, anxiety and fear. This perception about Mathematics in a way makes students believe that they cannot do this subject and it is a very difficult subject. So, in order to understand middle-stage students' perception on Mathematics, the researcher conducted a qualitative study that examined how students perceive the subject before and after an Experiential Learning intervention module based on Kolb's Experiential Learning cycle. Forty, grade 8 students from an urban school were selected through purposive sampling and open-ended questionnaires were given before and after the intervention. The open-ended questionnaire, which was a pre-perception tool, explored students' initial thoughts about Mathematics, their engagement levels, challenges and preferred ways of learning. The post-perception open-ended questionnaire tool focused on how their perceptions changed after participating in the Experiential Learning Approach. The data were analysed using Braun and Clarke's six-step Thematic Analysis to organize the open-ended responses into meaningful themes and sub-themes. The analysis indicated a shift in students' perceptions. Initially, many students mentioned fear, low confidence and a strong dependency on memorization and also found Mathematics was difficult, boring and lacked real-life connection. However, after the intervention module, students had an increased interest, improved confidence and a deeper understanding of concepts. Hands-on activities, real-life tasks, group collaboration and chances to think and explain their reasoning helped students to engage better with the subject. Overall, the results show that Experiential learning positively influenced students' perceptions, making Mathematics more accessible, engaging, developing problem solving skills and connecting it to real-world understanding**.**

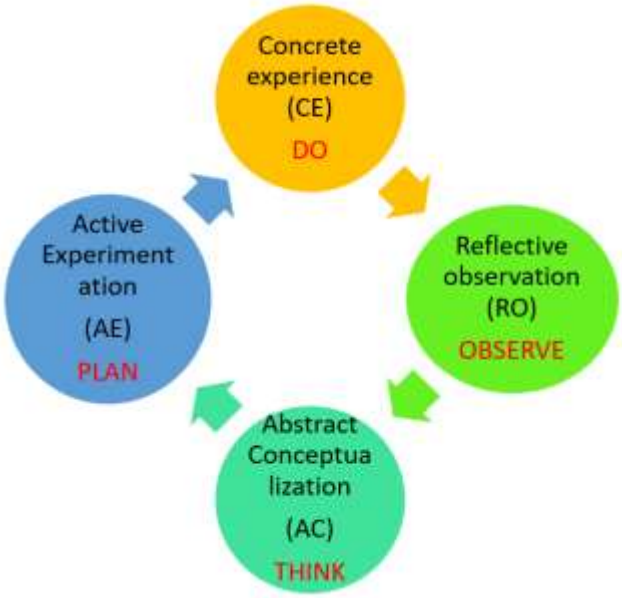
Index Terms **- Experiential Learning, Kolb Cycle, Perception, Mathematics, middle stage students**

Learning is the process whereby knowledge is created through the transformation of experience."— Kolb (1984)

I. Introduction

In today's digital age, students can access information instantly at their fingertips, reducing their dependence on teachers as sole providers of knowledge and the teacher's role is from a knowledge-giver to a facilitator. As students are responsible for their own learning, it is the teacher's role to give them different experiences that make their learning lifelong. To fulfil this necessity, many countries adopted a Constructivist Learning Approach and they organized their own institutions of education accordingly. Constructivism, which is, at the same time, an epistemological theory and a concept, is a knowledge and learning Approach (Haney and McArthur, 2002), in which students create their own knowledge as active participants, the classroom is filled with activities that create interests and satisfy the needs of different students, bringing about collaboration to provide creative thinking to create their knowledge. (Taylor, Fraser and Fisher, 1997). In such an environment, students are motivated and directed to solve the problem with collaborative work. While doing these works, students' experiences are taken into account (Rice and Wilson, 1999). The 21st century classroom is a combination of different teaching and learning pedagogies that include project-based training methods, blended learning, Experiential Learning Approach and techniques based on collaborative work are used in order to make learners active (Means and Olson, 1995).

In mathematics classrooms, these shifts hold particular significance, as students' perceptions of mathematics are strongly influenced by the nature of their learning experiences. Ma and Kishor (1997) suggested that perception toward Mathematics has been a major concern in Mathematics education research. Students dislike Mathematics as they have developed negative attitudes and have a perception that it is a difficult subject compared to any other subject (Rodríguez et al., 2020), as this subject evokes feelings of stress, anxiety and fear. The question is why some students struggle with numbers and calculations while others do not appear to face similar problems. Students fear and get nervous for Mathematics (Mensah, Okyere, & Kuranchie, 2013) which eventually results in avoiding math related tasks. Ramanujam (2012) mentioned that excessive use of procedure and the pressure of Board examinations and entrance examinations for access to prestigious institutions have created a culture of highly competitive preparation among the urban elite, and this has taken a toll on meaningful Mathematics. Ma and Kishor (1997) suggested that perception toward Mathematics has been a major concern in Mathematics education research. Daud, Adnan, Aziz, & Embong, 2020 defined perception as students' personal view about Mathematics subject, their feeling and thinking about how to learn Mathematics. This also depends on their past experience, background of the learner and the experience obtained from the classroom (Hannula, 2007). The fear, anxiety and negative thoughts can also be addressed through the use of teaching-learning methods that encourage students to find meaning and joy in Mathematics and assessment methods that do not kill this joy. Interactive teaching-learning methods involving play, exploration, discovery, discussion, games and puzzles may also help counter this fear, anxiety and negative perception towards Mathematics. When students engage in hands-on activities, collaborative problem-solving and real-life applications, they begin to see mathematics not as a set of rigid procedures but as a meaningful and relatable discipline. To cater to this approach of learning Mathematics, the researcher used the Experiential Learning Approach given by David Kolb as an intervention module to examine its impact on Mathematics on middle stage students. Kolb Experiential Learning cycle has four stages for effective learning. Concrete experience (CE), reflective observation (RO), abstract conceptualization (AC) and active experimentation (AE).



Kolb Experiential Learning Cycle (1984)

a) Concrete experience (CE) - In this stage, students are engaged personally in a new experience or situation (Chesimet, Githua, & Ng'eno, 2016). Akella(2010) stated that this experience can take place in the present or by reliving a recent event but feelings and interpersonal relationships are important.

b) Reflective observation (RO) – In this stage, the learners make sense of the experience, by focussing on the understanding of ideas and concepts by careful observations. Since collaboration at the initial stage gives them a different perspective to the learning experience.

c) Abstract Conceptualization (AC) – In this stage, students use logic and a systematic approach to solve problems. Chesimet, Githua, and Ng'eno (2016) found that collaboration takes place initially, students share their reactions and observations about the experiences thus leading to provide answers to the question arising from the experiences.

d) Active Experimentation (AE) - This stage enables learners to act pragmatically—to base their actions on their concrete experiences—in active experimentation with an encounter with a new concrete experience. This involves testing the fittingness of abstract conceptualizations formulated against new concrete experiences. Emphasis on practical applications and testing theories that lead into new experiences.

In Experiential learning, students are involved, active, engaged and responsible for their own learning which brings in holistic development. This aligns with Gandhi's definition of education, which emphasizes that education should be an all-round drawing out of the best in a child and man—body, mind and spirit.

Barete and Taja-on (2024) used hermeneutic phenomenological narrative inquiry with six college students and reported that real-world applications and positive learning experiences enhanced motivation, engagement, and appreciation of mathematics.

Shone et al. (2023) implemented an intervention to improve Grade 12 students' mathematical perception and self-efficacy using a quasi-experimental mixed-method design (n=394). Intervention training significantly improved perception and achievement. The researcher highlighted the importance of teacher training for sustaining such improvements.

Sasidharan and Kareem (2023) used a phenomenological approach to explore Grade 8 students' perceptions of mathematics in urban South India. Through semi-structured interviews and thematic analysis, they identified five major influences—student factors, teacher roles, content, classroom environment, and utility value. Supportive teachers, collaborative activities and open questioning were key contributors to positive perceptions. The study, however, lacked generalisability and did not include intervention-based evidence.

Singh et al. (2023) investigated first-year undergraduate students' attitudes using an 11-item Likert scale. Students acknowledged the relevance of mathematics; many found it difficult due to traditional teaching and limited conceptual clarity. The study highlighted the importance of teacher motivation, interactive strategies, and real-life contexts for improving perceptions.

Fekumo and Omeka (2022) examined junior secondary students' perceptions (n=170) in Nigeria and found mathematics perceived as abstract and difficult. Language background significantly influenced perception and performance. The study suggested reducing complex terminology but did not test any corrective intervention.

Mahapatra and Sahoo (2022) examined attitudes of secondary students across school types (n=200). Students from private and aided schools showed more positive attitudes than those in government schools, while gender and locality differences were insignificant. The study focused largely on quantitative comparison and paid limited attention to instructional factors shaping perception.

Mahajan (2021) administered the Mathematics Attitudes and Perceptions Survey (MAPS) to students from Classes 6–12 (n=113). Most students expressed interest and persistence in mathematics; sense-making correlated with other positive attitude dimensions. However, the study lacked examination of classroom practices influencing these attitudes.

Dash and Raghavan (2020) studied postgraduate management students (n=55) and found peer influence to be the strongest determinant of mathematical perception. They suggested structured peer-learning activities, though the study's reliance on self-report and small sample size limits broader applicability.

Noor et al. (2020) compared traditional and experiential learning in basic hydraulics (n=120). Students in the experiential group reported higher engagement and understanding, supporting the value of real-world problem-based activities.

Bordoloi (2019), using an open-ended questionnaire with 206 secondary students, found that most students perceived mathematics as difficult, abstract, and disconnected from daily life. Poor conceptual foundations and lack of engaging pedagogy contributed to negative attitudes. The use of a self-developed tool limited reliability.

Although several studies mentioned above have examined students' attitudes and perceptions towards mathematics, most studies mentioned above had quantitative surveys and cross-sectional designs as a research design and many studies have identified factors that include negative perceptions, such as teacher-centred instruction and abstract content, but very few studies have implemented classroom interventions module to examine how these perceptions can be transformed and only a limited number of qualitative studies have been conducted at the middle-school level that documents students' feelings, emotions and perceptions before and after exposure to Experiential Learning practices. Thus, there exists a clear gap in the literature regarding intervention-based, qualitative investigations that explore how Kolb's Experiential Learning Cycle can help reshape middle-stage students' perceptions of

mathematics. The present study addresses this gap by employing a pre- and post-perception qualitative design within an authentic classroom setting.

II. Research Question

What is the effect of the Experiential Learning Approach on the perception of middle stage students about Mathematics?

III. Objective of the study

To examine the impact of the Experiential Learning Approach on middle stage students' perceptions on Mathematics.

IV. Methodology

This study employed a single-group pre-test–post-test research design to investigate the impact of the Experiential Learning Approach on eighth-grade students' perceptions of mathematics. In this design, the same group of students was assessed before and after the instructional intervention. This design enabled the researcher to compare changes in students' perceptions about Mathematics when taught using Experiential Learning Module through qualitative data.

Group	Pre-test	Treatment	Post- test
Experiment	O1	X	O2

O1 : Pretest , O2 : Posttest , X : treatment

V. Sample of the Study

The study sample consisted of forty students of grade 8th from a private CBSE school in an urban area. All students present on the day of data collection were included in the study. This intact class received instruction through the Experiential Learning Approach as part of the intervention.

VI. Tools Used

The researcher developed an open-ended questionnaire on students' perception of Mathematics to understand their authentic thoughts, feelings and experiences. The questionnaire was reviewed by subject experts for content validity and piloted with a small group of students to check clarity and relevance. It was then administered to the experimental group, allowing students to provide detailed responses in their own words before and after the implementation of the module. The pre test open ended questionnaire revolved around students' thoughts on how they feel about Mathematics subject, their engagement, their approach and the way students prefer to learn Mathematics and the post test questionnaire include question based on the way Experiential Learning made them feel about Mathematics, their engagement in Mathematics classroom.

VII. Statistical Procedures Employed

Since the present study involved a single experimental group and focused on understanding their perceptions about Mathematics before and after the implementation of the Experiential Learning Approach, the researchers used qualitative analytical procedures and students' perceptions about Experiential Learning Approach were analyzed using Braun and Clarke's (2006) Thematic Analysis framework which includes six systematic steps.

VII. Procedure

In this study, the researcher first started with six pre-open-ended questionnaires to explore students' initial perceptions about Mathematics. Students then underwent an Experiential Learning Approach designed according to Kolb's Experiential Learning Cycle, which involved activities such as preparing a business plan, engaging in role play, and constructing models to apply mathematical ideas in real contexts. After completing the intervention, seven post open-ended questionnaires were administered to capture shifts in students' perceptions via Experiential Learning Approach.

VIII. Results / Findings

The findings of the researcher is given in the tabular form

1. What thoughts do you get while learning a mathematical concept?

Theme	Sub-theme	Description	N	%
Student Thought Processes & Emotional Reactions	Mixed emotions	Students felt excited, fun, fearful, nervous, angry, frustrated and bored.	10	25%
	Challenges & complexity	Students found concepts difficult and confusing; felt discomfort when the difficulty level of the concept rises.	9	22.5%
	Deeper understanding	Students mainly focussed on understanding the concepts on a deeper level and wanted to develop their foundation.	8	20%
	Lack of confidence	Doubt in students' minds reduces their confidence in problem solving.	4	10%
	Connection to real life	Students prefer linking concepts to real-world examples.	3	7.5%

2. How do you tackle conceptual problems?

Theme	Sub-theme	Description	N	%
Approaches to Tackling Problems	Seeking help	Students prefer taking help from teachers, parents, siblings, YouTube, apps.	18	45%
	Independent strategy	Some students use different strategies to solve problems independently. They use formulas, visualize the concept, break into steps, practice independently.	12	30%

Theme	Sub-theme	Description	N	%
	Mastery through repetition	At times memorising steps, solving more similar types of questions from multiple books.	10	25%

3.Do you remember the steps or solve them conceptually?

Theme	Sub-theme	Description	n	%
Conceptual vs Memorisation	Hybrid strategy	Students prefer combining formulas and conceptually understanding the concepts	12	30%
	Conceptual preference	Some students prefer understanding the principles behind questions.	14	35%
	Step memorisation	Some prefer memorising steps for accuracy and confidence.	10	25%
	Practical application	Very few prefer applying math in daily-life situations	4	10%

4. **Does studying math promote engagement in your classroom?**

Theme	Sub-theme	Description	n	%
Classroom Engagement	Positive engagement	Some students mentioned discussion improves interest and hence engaged in learning	10	25%
	Lack of engagement	Most students mentioned repetition, monotony while doing the exercise questions, less discussion and hence boredom.	17	42.5%
	Need improved methods	Some students also mentioned more activities and different strategies to make it interactive.	13	32.5%

5. What activities do you want in your math classroom?

Theme	Sub-theme	Description	n	%
Catering to Learning Preferences	Desire for challenges	Students prefer quiz, competitions, battles and mental math which bring challenges	12	30%
	Engaging activities	Games, puzzles, hands-on projects, outdoor tasks to make students get involved in their own learning	22	55%
	Practical learning	Activities that show real-life relevance.	6	15%

6. **How do you want to learn mathematics?**

Theme	Sub-theme	Description	n	%
Desire for Meaningful Learning	Better conceptual understanding	Students want clear, simplified learning which leads to less memorisation and hence better conceptual understanding	17	42.5%
	Creative teaching	Students want innovative tools, videos and interactive activities.	12	30%
	Learning with joy	They prefer meaningful, fun and lively learning.	11	27.5%

Post-Perception Questionnaire

1. What thoughts did you have while learning a mathematical concept through the Experiential Learning Approach?

Theme	Sub-theme	Description	n	%
Change in Thoughts	Edutainment	Students mentioned that math had become fun, joyful and entertaining as they were enjoying it.	13	32.5%
	Innovative learning	Students felt they have worked on creative ideas, new approaches which gave them a fresh perspective to the subject	11	27.5%
	Learning with groups	Students got an opportunity for peer interaction, teamwork, shared strategies which leads to collaborative learning.	7	17.5%
	Change in attitude	Students felt that there is a shift from negative to positive perception about math.	5	12.5%
	Missing traditional method	Few students still prefer structure and old methods of learning Mathematics.	4	10%

2. How did you approach or solve conceptual problems in Mathematics while using the Experiential Learning Approach?

Theme	Sub-theme	Description	n	%
Improving Mind & Skills	Inquiry-based learning	Students highlighted asking questions, exploring different ideas, deeper thinking to give a rationale behind their activities	12	30%
	Problem-solving skills	Students mentioned better formula understanding which helps them become confident and develop their problem-solving skills	13	32.5%
	Taking ownership	The activities were self-monitoring as it made them do independent learning and reflect their product, app or model.	15	37.5%

3. While learning through Experiential Learning, did you rely more on remembering steps or solving conceptually?

Theme	Sub-theme	Description	n	%
Focus on Understanding	Better performance	Students pointed out that solving conceptually has improved their scores and accuracy.	4	10%
	Retention of concepts	Experiential activities help them to have a stronger memory and a deeper grasp of ideas.	18	45%
	Real-world connection	Students are able to link math to daily life and real situations.	9	22.5%
	Understanding & comprehension	Students have developed a clear logic, strong foundation and deeper meaning.	9	22.5%

4. How does learning Mathematics through the Experiential Learning Approach affect your engagement in the classroom?

Theme	Sub-theme	Description	n	%
Personal Growth	Active participation	Students were more involved, confident and had better performance.	13	32.5%
	Observational learning	Students learn by seeing diverse ideas and presentations.	17	42.5%
	Collaboration & discussion	Students learnt social skills while doing group work, shared ideas and learned to contribute equally.	9	22.5%

5. What activities did you enjoy during the Experiential Learning Approach and how did they help you understand Mathematics?

Theme	Sub-theme	Description	n	%
Educational Engagement & Skill Development	Developing questioning techniques	Students highlighted that asking questions and analyzing peers' ideas help them build up questioning skills.	7	17.5%
	Active learning	It made their memory better and gave them hands-on participation.	8	20%
	Career simulation	As they could visualise and experience different career aspects.	6	15%
	Learning by doing	Preparing Models, 3D tasks gave them hands-on clarity.	8	20%
Effective Learning Experience	Real-world relevance	Students were very happy about being able to connect math to real life examples.	6	15%
	Peer-to-peer learning	Ability to solve Doubt, learning from peers made them feel connected in the classroom.	5	12.5%

6. Will you prefer learning Mathematics using an Experiential Learning Approach? Explain your answer in 2 to 3 lines.

Theme	Sub-theme	Description	n	%
Joyful Learning	Increased interest	Students were of the opinion that Math became easy, more enjoyable and gave them a positive attitude.	7	17.5%
	Better confidence	As students felt their ability to solve problems had improved, they felt confident in solving questions	16	40%
	Different perspectives	Students learnt fresh viewpoints on different planned activities, creative thinking and deeper logic.	7	17.5%

7. Did you face any challenges while learning Mathematics through Experiential Learning Approach?

Theme	Sub-theme	Description	n	%
Challenges in Time & Coordination	Time constraints	Students mentioned that activities took longer time	14	35%
	Group dynamics	Some dynamics in a group like inactive members, conflicts lead to delayed work.	15	37.5%
	Assessment disconnects	Students highlighted an important point that activities are fun but exams are still traditional.	5	12.5%
	Task complexity	At times some tasks were difficult like 3D models, business plans.	6	15%

IX. Discussion

The pre-perception findings gathered by the researcher before the implementation of the intervention module provided valuable insights into how students initially perceived mathematics, the common strategies they used to solve problems and how the monotonous, teacher-centred nature of traditional classrooms often leads to reducing their engagement in the subject. Students also expressed that if their mathematics classroom can be more interactive, meaningful and enjoyable that could support their learning. After the implementation of the Experiential Learning Approach (ELA), the post-perception results indicated a clear and positive shift in their attitudes toward learning mathematics. The Experiential Learning activities planned by the researcher such as role play, business planning, modelling, pitching and group activities transformed mathematics from a passive, memorisation-driven subject into one that students described as fun, creative, and easier to understand, that aligns with Dorland's (2024) finding that Experiential Learning enhances creativity, interpersonal skills and learning abilities. This transformation resonates with Mat Zin and Mohd Zain (2010), who emphasised that edutainment offers students new opportunities to acquire information in engaging ways, and with Leal-Rodríguez and Albort-Morant's (2019) conclusion that experiential strategies deepen conceptual understanding and improve performance. Radović et al. (2021) further noted that Experiential Learning naturally incorporates social interaction, fostering collaboration and social skill development—an aspect strongly reflected in students' responses in this study. Students who initially perceived mathematics as difficult, boring, or intimidating reported more positive emotions after the intervention, describing learning as enjoyable, meaningful and more connected to real-life contexts. The approach strengthened their problem-solving abilities and encouraged a sense of ownership, as students monitored their progress, questioned ideas, and reflected on outcomes, supporting Kwon's (2024) perspective that Experiential Learning promotes innovation, exploration and creative alternatives to solve diverse problems. Similarly, Marinković and Špiranec (2012) highlighted that immersive, activity-based tasks cultivate robust problem-solving and reflective thinking skills. Efstratia (2014) also affirmed that Experiential Learning connects academic content with real-world challenges, nurturing both cognitive and emotional capacities. Although some students reported challenges such as time management, group coordination and handling complex tasks, these difficulties are characteristic of adjusting from traditional instruction to active, experience-based learning. Overall, the findings indicate that ELA significantly reshaped students' perceptions of mathematics by making learning interactive, relevant, and student-centred, resulting in improvements across both cognitive and affective dimensions of learning.Although some challenges—such as time management, group coordination and difficulty with complex tasks—were noted, these reflect the natural adjustment from traditional methods to an experiential framework. Overall, the results demonstrate that Experiential Learning Approach significantly reshaped students' perceptions of mathematics by making learning interactive, relevant, and student-centred, leading to both cognitive and affective improvements in how students think about and engage with the subject.

X. Conclusion

The study showed an improvement in students' perceptions about mathematics after the implementation of the Experiential Learning Approach. During the intervention module students were learning in a fun way, highly engaged and confident as they were experiencing different stages of the Kolb cycle through hands-on and real-life activities that naturally made mathematics more meaningful and easier to understand. Collaboration among students leads to peer learning, questioning, communication and ownership of learning. Across all post-test themes, students exhibited positive affective and cognitive shifts—moving from boredom, fear, and memorisation-based approaches toward curiosity, motivation and active participation. They also mentioned the challenges related to Experiential Learning Approach that includes it being time consuming, at times the task used to be complex as it did not involve only solving of the exercise question but thinking about different activities and group coordination were noted, the overall findings strongly affirm that Experiential Learning Approach transformed students' perceptions of mathematics in a positive direction. The study highlights the need for mathematics classrooms to incorporate Experiential components such as hands-on activities, real-world modelling, group-based tasks and reflective practices. Teachers can use ELA to foster problem-solving ability, communication, creativity, and decision-making skills. The findings suggest that when students connect mathematics to real-life contexts, their motivation and confidence increase, leading to more sustained engagement. For schools, this implies the importance of providing resources, time, and training for experiential methods. The use of collaborative structures and project-based tasks can help cater to diverse learners, particularly those who struggle in traditional lecture-based environments. Integrating experiential learning can therefore serve as an effective tool to improve student attitudes, reduce math anxiety, and enhance classroom participation.

XI. Limitation of the study

As the study relied on qualitative data from a single group of 40 students within one school context, the generalizations of the findings is limited. The analysis depends on self-reported perceptions, which may be influenced by personal biases or social desirability. The intervention duration was relatively short, which might not fully capture long-term effects on perception or achievement. Additionally, the study did not quantitatively measure the relationship between perception and performance outcomes, which restricts the scope of interpretation.

XII. RECOMMENDATIONS FOR FUTURE RESEARCH

Future studies can be conducted in order to explore the long-term impact of Experiential Learning on both perception and academic achievement using mixed-method or longitudinal designs. Expanding the sample to include multiple schools or grade levels would allow broader generalisations. Further research may also explore how teacher training, resource availability, and classroom structure influence the effectiveness of experiential methods.

XIII. ACKNOWLEDGMENT

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