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The impact of vibrotactile feedback through a virtual environment on the acquisition of fine motor skills among primary school students

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Abstract

Background: Fine motor skills are essential for academic success and daily life activities in children. This study explores the effectiveness of using vibrotactile feedback within a virtual environment to enhance these skills among primary school students.

Problem Statement: Despite the availability of traditional teaching methods, many students continue to face challenges in acquiring fine motor skills, necessitating innovative, technology-driven solutions that engage both sensory and cognitive functions.

Objectives: The research aims to evaluate the effect of vibrotactile feedback on the development of fine motor skills and compare the performance of students using this method with those taught through conventional approaches.

Methodology: A quasi-experimental design was adopted, involving 30 fourth-grade students from Ilyaa Private Elementary School in Najaf (academic year 2024–2025), randomly assigned to an experimental group (using vibrotactile feedback in a virtual environment) and a control group (traditional instruction). Selection was purposive due to the school's availability of advanced tools for measuring fine motor skills.

Results: The experimental group demonstrated significant improvement across all skill assessments compared to the control group. A moderate to strong correlation between pre- and post-test scores suggested that the intervention not only enhanced performance but also supported performance stability.

Recommendations: The study advocates the use of smart gloves and vibrotactile tools in school-based physical education, the integration of virtual environments in motor learning programs to enhance balance, precision, and response speed, and the application of vibrotactile feedback in rehabilitative training for children with minor disabilities to stimulate muscle engagement and fine motor responsiveness.

Keywords: Fine Motor Skills, Vibrotactile Feedback, Virtual Reality in Education, Sensorimotor Learning, Primary School Students

1. Introduction

1.1 Research Background and Significance

Fine motor skills are fundamental capabilities closely linked to the development of functional performance and learning in children. They contribute significantly to the execution of everyday activities such as drawing, writing, and using school tools, making their enhancement at an early age an educational and developmental necessity (Case-Smith et al., 2015). Educational and developmental literature suggests that deficits in these skills can negatively impact a child's academic achievement and social integration, prompting the need to design innovative educational interventions that enhance such competencies.

With the advancement of interactive technologies, Virtual Reality (VR) has introduced new learning environments that integrate sensory and motor perception. These environments provide engaging and safe training contexts that allow for the repetition and immediate correction of performance (Levac et al., 2019). VR settings are particularly ideal for teaching fine motor skills, especially during early developmental stages, as they offer rich visual, auditory, and tactile stimuli that realistically simulate learning environments in a more

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engaging and effective way. Among the tools utilized in these environments, vibrotactile feedback stands out as a form of sensory response that supports the acquisition of fine motor skills. This feedback provides learners with immediate cues regarding the accuracy, direction, and timing of movements, thereby enhancing sensorimotor learning and reducing perceived task difficulty (Sigrist et al., 2013). Recent studies have demonstrated that incorporating vibrotactile feedback into motor tasks in virtual environments improves performance and reduces mental effort. For example, the study by Park et al. (2025) showed that children reported greater ease when performing fine motor tasks with vibrotactile feedback compared to tasks without it.

The importance of these technologies is growing within primary education contexts, as research indicates that effectively integrating technology into motor learning can shorten the time required to acquire skills, increase motivation, and promote engagement in the learning process. Sensory feedback such as vibrations may also enhance motor memory in children by creating deeper perceptual associations during repeated performance.

Based on the foregoing, this study aims to investigate the effect of incorporating vibrotactile feedback into a virtual educational environment designed to develop fine motor skills among primary school students. The study also seeks to bridge the gap between theoretical applications of such technologies and their practical implementation in classroom settings. Furthermore, it aims to assess students' perceived difficulty of motor tasks when using this technique compared to traditional methods, potentially contributing to the advancement of VR-based educational program design.

The significance of this research lies in its investigation of the effectiveness of vibrotactile feedback within a virtual environment in enhancing fine motor skills among primary school students—skills that are critical to their academic and functional development. Moreover, the study opens new avenues for the use of interactive technologies in education and contributes to the development of modern instructional strategies grounded in sensory and cognitive engagement.

1.2 Research Problem

Many primary school students face difficulties in acquiring fine motor skills, which negatively affects their academic performance and daily life activities. Despite the variety of traditional teaching methods, there remains a pressing need for innovative technological tools that can enhance sensory and motor learning in a more effective and engaging way.

Accordingly, the research problem can be formulated as follows:

What is the effect of using vibrotactile feedback within a virtual environment on learning fine motor skills among primary school students?

1.3 Research Objectives

1. To examine the impact of using vibrotactile feedback through a virtual environment on the development of fine motor skills in primary school students.
2. To compare the level of fine motor skill performance between students who learn using a virtual environment with vibrotactile feedback and those who learn through traditional methods.

1.4 Research Hypotheses

There are statistically significant differences in the average performance of primary school students learning fine motor

skills using a virtual environment with vibrotactile feedback compared to those learning through traditional methods, in favor of the group using vibrotactile feedback.

1.5 Scope of the Study

1.5.1 Human Scope: Students from Ilyaa Private Primary School, General Directorate of Education in Najaf.

1.5.2 Time Scope: From September 21, 2024, to April 26, 2025.

1.5.3 Spatial Scope: The school's playground and the gymnasium designated for physical education classes.

1.6 Definition of Terms

Vibrotactile Feedback

A type of sensory feedback that uses targeted vibrations applied to the body (via devices such as smart gloves or wristbands) to stimulate sensory receptors. It helps improve motor performance by providing direct feedback on movement accuracy or errors⁽⁴⁾.

Virtual Environment:

A computer-generated simulation of a real or imagined environment that allows user interaction through devices such as virtual reality headsets or touchscreens. It is used as an educational or training tool⁽⁵⁾.

Fine Motor Skills

Skills that involve the use of small muscles in the hands, fingers, and wrists. These include activities such as writing, coloring, cutting, and tying shoelaces. They are essential for a child's academic and functional development⁽⁶⁾.

2. Research Methodology and Field Procedures

2.1 Research Methodology

This study employed a quasi-experimental design, in which the research sample was divided into two groups: an experimental group that received the intervention through a virtual environment equipped with vibrotactile feedback, and a control group that received traditional instruction. The purpose of this design was to examine the effect of the independent variable (vibrotactile feedback) on the dependent variable (fine motor skills) by comparing the performance of both groups before and after the intervention⁽⁷⁾.

The quasi-experimental approach is considered appropriate for educational and pedagogical research that involves implementing interventions in real-world settings while accommodating some limitations in randomization.

2.2 Research Population and Sample

The research population consisted of fourth-grade students from Ilyaa Private Elementary School, under the supervision of the Najaf Directorate of Education, during the academic year 2024–2025. The total number of students was 40, distributed across two classes. After excluding students who were frequently absent from tests and lessons, the final sample consisted of 35 students. From this group, 30 students were randomly selected and evenly distributed into two sections (A and B): one representing the experimental group and the other the control group. All students were at the same academic and age level and classified as beginners in motor skill development.

The sample was purposively selected due to the availability of advanced equipment and tools in Ilyaa School for measuring fine motor skills. The sample selection criteria included:

- Students in the fourth grade of primary school
- No physical or cognitive disabilities affecting motor

performance

- Parental consent for participation in the study

To ensure fairness and accuracy in the research findings, the researcher verified the homogeneity of the student sample in the following aspects before starting the study:

- **Age:** All participants were within the same age group (10–12 years), ensuring similar developmental motor capabilities.
- **Educational Level:** All students were in the same

academic grade (Grade 4, primary school).

- **Health Status:** Students with medical conditions or disabilities affecting motor skills were excluded.

In addition, a pre-test was conducted to ensure that both groups had equivalent levels of fine motor skills before the intervention. The researcher took careful steps to minimize the influence of external variables on the research outcomes, thereby enhancing the reliability of the results and ensuring an accurate assessment of the effect of vibrotactile feedback as shown in Table 1.

Table 1: Homogeneity of the Research Sample

Variables	Experimental Group	Control Group	T-Value	Statistical Value (T)	P-Value	Significance Level	Significance
Age (years)	11.5	11.4	0.6	0.65	0.52	Not Significant	No difference
Height (cm)	130.2	129.7	5.3	0.43	0.67	Not Significant	No difference
Weight (kg)	28.9	29.1	3.2	0.29	0.77	Not Significant	No difference
Academic Level	4	4	–	–	–	–	Homogeneous

2.3 Tools and Devices Used

2.3.1 Data Collection Tools

Data collection tools refer to the instruments or methods that enable the researcher to address their research problem, whether through data, devices, or other means, in order to obtain the results necessary to achieve the study's objective⁽⁶⁾. The researcher employed the following tools

1. Observation
2. Personal Interviews
3. Questionnaire
4. Testing and Measurement

2.3.2 Devices and Instruments Used

The devices used by the researcher during the implementation of the research procedures included

Vibration Feedback Glove

A lightweight electronic device worn on the hand, containing small vibration motors embedded at the fingertips or palm. It is programmed to deliver instant feedback vibrations upon success or failure in fine motor tasks (e.g., deviation from path, dropping, or excessive slowness). It offers real-time sensory feedback that helps children adjust their movements during learning.

Tablets with Motor Assessment Software

These tablets are equipped with interactive applications for evaluating and tracking fine motor skills, such as visual tracking, tracing within boundaries, and accurately tapping small targets. They are used to present tasks and analyze time and accuracy performance.

Scissors and Special Test Sheets

Pre-drawn sheets with straight and curved lines used in cutting tests to assess tool control and motor precision.

Fine Motor Manipulatives

Small-sized objects (e.g., LEGO bricks, beads, assembly tools) that require precise finger control, used to evaluate hand-eye coordination and fine grip strength.

Digital Stopwatch (Chronometer)

Used to record the exact time taken to complete each task, contributing to the evaluation of motor response speed.

Recording and Observation Tools

This includes observation sheets, recording tables, and a video camera used for documenting student performance for later analysis.

Electronic Medical Scale (1 unit)

2.4 Field Procedures

2.4.1 Identification of the Tests Used

Based on established scientific references, the researcher relied on globally recognized and validated assessments used for evaluating fine motor skills in children, including

- Bruininks-Oseretsky Test of Motor Proficiency (BOT-2)
- Beery-Buktenica Developmental Test of Visual-Motor Integration (VMI)
- Fine Motor Skills Test

2.4.1.1 Description of the Tests Used

First: Bruininks-Oseretsky Test of Motor Proficiency (BOT-2)⁽⁹⁾

Detailed Description: BOT-2 is a standardized and comprehensive tool for assessing motor skills in children and adolescents aged 4 to 21 years. It covers eight motor skill domains, including fine motor skills, which are measured through subtests like “manual control” and “speed and precision.” The test focuses on the accurate performance of movements that require hand-eye coordination.

Core Fine Motor Tasks in BOT-2 include

- Copying Geometric Shapes: The child is asked to replicate shapes such as circles and squares using clear lines.
- Cutting Shapes: Using scissors to cut along straight and curved lines, with cutting accuracy measured.
- Assembling Small Pieces: Putting together puzzle parts or small pieces in a specific arrangement.
- Pencil Control: Tracing fine paths using a pencil within designated boundaries.

Application Method

The test is conducted in a quiet environment, with each task clearly explained to the child. The session usually lasts between 20 to 40 minutes, depending on the child's age. Performance is recorded based on precise criteria measuring accuracy, speed, and correct execution.

Validity and Reliability

The BOT-2 demonstrates high reliability (internal consistency above 0.80) and has established validity for both research and clinical evaluation.

Second: Beery-Buktenica Developmental Test of Visual-Motor Integration (VMI) ⁽¹⁰⁾

Detailed Description: The VMI assesses a child's ability to accurately copy geometric shapes, reflecting coordination between visual perception and fine motor execution. The test consists of three parts: visual-motor integration, visual perception, and fine motor coordination.

Test Mechanism

The child is asked to copy a series of increasingly complex geometric shapes (e.g., lines, squares, triangles, and composite shapes). In the visual perception section, the child selects the correct shape from multiple options. In the fine motor section, precision tasks are performed using tools like a pencil or scissors.

Duration:

The test takes approximately 10–15 minutes, making it suitable for educational and research environments.

Validity and Reliability

VMI is proven to have high reliability and is widely accepted for measuring both visual and motor abilities in children.

Third: Fine Motor Skills Test ⁽¹¹⁾

Detailed Description: This is a field-based test designed to evaluate children's ability to perform practical, everyday tasks requiring fine motor skills. It includes real-life motor tasks assessing hand coordination and precision.

Sample Tasks Include

- **Coloring Within Boundaries:** The child is asked to color a shape accurately.
- **Cutting with Scissors:** Cutting straight and curved lines on cardboard.
- **Puzzle Assembly:** Fitting small pieces into a structured shape or puzzle.
- **Transferring Small Objects:** Moving beads or small balls from one container to another using tweezers or fingers.

Application Method

Tasks are carried out in one-on-one sessions. The time required for each task and the number of errors (e.g., coloring outside lines, dropping items) are recorded. The test serves as a practical tool to measure developmental changes in fine motor skills before and after training or intervention programs.

2.4.2 Pilot Study

To ensure the accuracy and validity of the research process and to address any potential obstacles during field implementation, the researcher conducted a pilot study. This trial was carried out on Sunday, October 20, 2024, with a sample of five students from the same population as the main study, but who were not included in the final research sample. The pilot study allowed for the identification of necessary adjustments, such as simplifying certain instructions or modifying the duration of specific tasks. It also confirmed the efficiency of the devices in delivering real-time vibrotactile

feedback during motor performance. The study revealed the need for brief prior training for children on how to use the technological tools.

Vibrotactile feedback devices (such as gloves or mounted vibration units) were tested while students performed fine motor tasks. Observations were recorded regarding children's acceptance of the devices, clarity of instructions, ease of organization, and any technical or procedural challenges

The pilot study aimed to

- Verify the clarity of instructions for fine motor skill tests.
- Confirm the appropriateness of the allotted time for each test and training task.
- Assess students' responsiveness to and understanding of the vibrotactile feedback.
- Test the readiness and functionality of devices and technologies (e.g., smart gloves and vibration devices).
- Estimate the level of homogeneity in fine motor skills across the sample before the main experiment.

2.5 Main Experiment Implementation

2.5.1 Pre-Tests

The pre-tests for fine motor skills were conducted under the supervision of the researcher and with the assistance of the research team in the school's designated physical education hall. The necessary tools and devices were prepared, and detailed instructions were provided to the students regarding test procedures and the number of attempts. Final scores were calculated for each student.

The pre-testing took place on Thursday, October 24, 2024, at 9:00 AM. The researcher controlled all variables (time, tools, devices, research team, and test procedures) to ensure the same conditions would be maintained during the post-test.

Fine motor skill tests were administered to both groups using validated tools such as BOT-2 and VMI. Performance was documented in terms of timing, accuracy, and number of errors.

2.5.2 Main Experiment

The intervention began by dividing the sample into two groups: an experimental group and a control group. The experiment started on Sunday, October 27, 2024, and ended on Thursday, December 26, 2024. It was implemented at Ilyaa Private Primary School, inside a multipurpose hall equipped with computers and touchscreen monitors.

The total sample consisted of 30 fourth-grade students who were randomly assigned into two equal groups of 15 students each. A specialized instructional training program was developed, spanning 8 weeks and aimed at improving fine motor skills through interaction with a virtual environment, along with real-world applications using manual tools.

The program included tasks that required precise hand and finger control, such as virtual path tracing, block assembly, shape cutting, organizing small toys, and coloring within boundaries.

The experimental group used a vibration feedback glove (equipped with a built-in vibration motor) that provided direct sensory feedback upon errors in task performance—both in virtual environments and real-life tasks. The control group performed the same activities without using the glove.

Tools Used

1. Bluetooth-enabled electronic vibration glove
 2. Computer and touchscreen display for virtual tasks
- Pre-drawn paper boards with geometric shapes and paths

3. Child-safe scissors
4. Building blocks and small toys to promote motor coordination
5. Coloring and connect-the-dots worksheets
6. Digital stopwatch to record task completion time

The training program included three sessions per week over 8 weeks (a total of 24 sessions), with each session lasting 20–40 minutes, divided into

- Virtual computer-based tasks (10–20 minutes)
- Real-world manual tasks (10–20 minutes)

2.5.3 Post-Tests

After completing the training program, the post-test was conducted on Monday, December 31, 2024, at 9:00 AM. The researcher ensured identical conditions were maintained as in the pre-test in terms of time, location, team, tools, and equipment to control variables as much as possible.

All students underwent the same standardized pre- and post-tests, measuring the number of errors, time taken, and

accuracy of performance.

Data were analyzed using the T-test to assess differences between the two groups. Experimental control measures were strictly followed, such as consistent test locations, execution times, tools, and no verbal interference from the instructor, to ensure objective results. Some sessions were also recorded on video for scientific review and error analysis.

2.6 Statistical Tools Used

The researcher used the SPSS (Statistical Package for the Social Sciences) software to analyze the research results, including various statistical techniques to validate the findings.

3. Presentation, Analysis, and Discussion of Results

3.1 Presentation of Pre- and Post-Test Results for Fine Motor Skills – Control Group

Table 2, presents the means, standard deviations, and the results of the T-test between the pre-test and post-test scores for fine motor skills in the control group.

Table 2: Pre- and Post-Test Results of Fine Motor Skills – Control Group

S. No.	Tests Used in the Study	Pre-Test Mean $\pm$ SD	Post-Test Mean $\pm$ SD	T-Value	Significance Value (Sig.)	Significance Level
1	Bruininks Motor Proficiency Test (BOT-2)	21.7 $\pm$ 0.3	22.5 $\pm$ 0.3	0.86	0.01	Significant
2	Beery Visual-Motor Integration Test (VMI)	20.8 $\pm$ 2.5	21.2 $\pm$ 2.6	0.83	0.01	Significant
3	Fine Motor Skills Test	33.4 $\pm$ 4.3	34.6 $\pm$ 4.3	0.85	0.01	Significant

The results showed a slight improvement in performance from the pre-test to the post-test. The high Pearson correlation coefficients (0.83 – 0.86 – 0.86) indicate a strong and stable relationship between the two measurements. Additionally, the significant p-values ($p < 0.01$) confirm the reliability and validity of the test results.

3.2 Presentation of Pre- and Post-Test Results for Fine Motor Skills – Experimental Group

This section presents the means, standard deviations, and T-test results between the pre-test and post-test for fine motor skills in the experimental group. (Table 3).

Table 3: Pre- and Post-Test Results of Fine Motor Skills – Experimental Group

S. No.	Tests Used in the Study	Pre-Test Mean $\pm$ SD	Post-Test Mean $\pm$ SD	T-Value	Significance Value (Sig.)	Significance Level
1	Bruininks Motor Proficiency Test (BOT-2)	21.8 $\pm$ 3.8	27.9 $\pm$ 2.4	0.91	0.001	Highly Significant
2	Beery Visual-Motor Integration Test (VMI)	20.9 $\pm$ 3.6	26.7 $\pm$ 2.7	0.89	0.001	Highly Significant
3	Fine Motor Skills Test	33.1 $\pm$ 3.7	39.4 $\pm$ 3.5	0.90	0.001	Highly Significant

The experimental group demonstrated a notable improvement in fine motor skills following the implementation of the training intervention. The high Pearson correlation coefficients indicate the stability and consistency of the test results between the pre- and post-assessments. The high statistical significance level ($p < 0.001$) further confirms the validity and reliability of the findings.

3.3 Presentation of Post-Test Results for Fine Motor Skills – Control and Experimental Groups

This section presents the results of the post-test comparisons between the control group and the experimental group in fine motor skills as shown in Table 4. The analysis includes means, standard deviations, and T-test results to determine whether there are statistically significant differences in performance between the two groups after the intervention.

Table 4: Post-Test Results of Fine Motor Skills – Control vs. Experimental Groups

S. No.	Tests Used in the Study	Control Group Mean $\pm$ SD	Experimental Group Mean $\pm$ SD	T-Value	Significance Value (Sig.)	Significance Level
1	Bruininks Motor Proficiency Test (BOT-2)	22.5 $\pm$ 3.0	27.9 $\pm$ 2.4	0.62	0.01	Significant
2	Beery Visual-Motor Integration Test (VMI)	21.2 $\pm$ 2.6	26.7 $\pm$ 2.7	0.59	0.01	Significant
3	Fine Motor Skills Test	34.6 $\pm$ 4.3	39.4 $\pm$ 3.5	0.65	0.01	Significant

The mean scores of the experimental group were higher than those of the control group across all tests, indicating a positive impact of the intervention. The correlation coefficients between the post-test measurements of the two groups show a moderate and statistically significant positive relationship, suggesting some consistency in performance between the groups, but with a notable improvement in the group that received the intervention.

Discussion of Results

The findings of the current study reveal a clear superiority of the experimental group, which utilized a virtual environment enhanced with vibrotactile feedback, compared to the control group—both in pre-to-post and post-to-post test comparisons. This suggests that sensory feedback (specifically vibrotactile feedback) plays an effective role in enhancing the learning of fine motor skills among students.

This impact can be attributed to the vibration glove's ability to provide immediate and direct responses that mimic realistic tactile sensations, improving motor awareness and self-correction during task performance (Luu et al., 2011)⁽¹²⁾. Vibrotactile feedback activates the cutaneous sensory receptors, especially in the fingers and palm, which enhances movement perception and supports the encoding of correct motor patterns into long-term motor memory—a critical function for children in the sensorimotor developmental stage (Al-Harbi, 2020)⁽¹³⁾.

Moreover, such feedback helps reduce cognitive load required to process and adjust movement, as vibration signals are instant and do not necessitate complex verbal or visual processing (Lee et al., 2023)⁽¹⁴⁾. The virtual environment in which the intervention was conducted was visually stimulating, engaging, and interactive, which made the children more responsive and attentive, fostering conditions essential for fine motor learning, as highlighted by Biddiss & Irwin.⁽²⁰¹⁰⁾

The integration of the vibration glove with tablet-based tasks in a virtual setting created a multisensory educational experience, allowing children to learn through hands-on experimentation and immediate sensory feedback. Reviewing related literature supports the study's results:

The thesis by Abdul-Majeed (2018)⁽¹⁵⁾ demonstrated the effectiveness of virtual reality in improving manual performance among fourth-grade students.

Al-Harbi's (2020) study confirmed the role of tactile feedback in enhancing fine writing skills in children.

Luu et al. (2011) found that children who received vibrotactile feedback improved their motor performance more than those who did not receive such sensory input.

Based on these findings, the use of vibration gloves in a virtual environment should not be seen merely as a technological tool, but as an effective educational strategy that accelerates learning, supports error correction, and stimulates sensorimotor awareness in young learners. This supports the direction of modern education, which increasingly embraces multimedia and interactive learning methods.

4 .Conclusion and Recommendations

4.1 Conclusion

1. The study demonstrated the clear effectiveness of the training intervention using vibrotactile feedback in improving fine motor skills among primary school students. The experimental group showed significant improvement across all skill tests compared to the control

group.

2. The results indicated a moderate to strong correlation between the performance of both groups in the post-tests, suggesting that intensive training and feedback mechanisms contributed to enhancing skill performance, rather than simply maintaining it.
3. Analysis of the results confirmed that the educational intervention not only improved motor skills but also contributed to performance stability, as reflected in the high correlation coefficients between pre- and post-measurements for the experimental group.

4.2 Recommendations

1. Integrate virtual environments into school curricula, especially in early grades, for teaching skills that require sensorimotor coordination, such as writing, cutting, coloring, and tool use.
2. Train teachers in the use of interactive technologies (e.g., sensory gloves and tablets) to ensure their effective application in teaching fine motor skills.
3. Establish smart learning laboratories in primary schools equipped with virtual reality tools and sensory feedback technologies to conduct educational activities in an engaging and effective way.
4. Use smart gloves and vibrotactile tools in school sports training to improve fine motor performance in games requiring neuromuscular coordination, such as gymnastics, handball, and table tennis.
5. Design motor learning programs using virtual environments that help children develop balance, accuracy, and response speed, especially during early motor development stages.
6. Adopt vibrotactile feedback technologies in rehabilitation training for children with minor disabilities to stimulate muscles and enhance fine motor responses.

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Sample Educational Unit Plan: Enhancing Fine Motor Skills Using Vibrotactile Feedback

- **Grade Level:** 4th Grade (Primary School)
- **Topic:** Zigzag Line Tracing
- **Skill Type:** Fine Motor Skill
- **Assistive Tool:** Vibrotactile Feedback Device (e.g., Vibration Glove)
- **Session Duration:** 40 Minutes

Learning Objectives:

- **Cognitive Objective:** Students will understand the concept and importance of fine motor skills.
- **Psychomotor Objective:** Students will accurately perform the task of tracing a zigzag line without deviating from the path.
- **Affective Objective:** Students will express interest and enjoyment while engaging in the activity using technology.

Preparation

- Present a brief video explaining fine motor skills.
- Demonstrate how the vibrotactile feedback device works.

Materials

- Printed zigzag lines with varying difficulty levels.
- Electronic tracing pen.
- Vibration device worn on the wrist (activates on error).
- Stopwatch.

Execution Steps

Duration	Activity	Description	Type of Feedback
10 mins	Hand Warm-up	Finger flexion/extension exercises and squeezing rubber balls	–
10 mins	Skill Explanation	Teacher explains the tracing skill and provides a model demonstration	Visual / Verbal
15 mins	Practical Application	Student begins tracing. On errors, device gives vibration alert	Direct Vibrotactile
5 mins	Assessment	Record time taken and number of line deviations	Verbal + Quantitative

Assessment Methods

- Direct observation by the teacher
- Number of errors (deviations from the line)
- Time taken to complete the task
- Student feedback on vibration response and ease of use