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CONSTRUCTION AND VALIDATION OF INDIGENIOUS PSYCHO-NEUROLOGICAL MANUAL DEXTERITY TEST: ABANINIK PSYCHO-NEUROLOGICAL MANUAL DEXTERITY TEST

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ABSTRACT

The project is designed for the construction and validation of an indigenous psycho-neurological manual dexterity test that is known as (ABANINIK PSYCHO-NEUROLOGICAL MANUAL DEXTERITY TEST). The manual dexterity test can used in the selection and placement of workers in the factories and companies. It can be used to select workers who work basically with their hands in Factories such as Bottling Companies, Pharmaceutical Companies, Confectionary Companies, and Textile Companies. This manual dexterity test can also detect the early signs of neurological breakdown (Parkinsonism). One-way Analysis of Variance and the T-test of independent measures was employed to manage the data of this research project. The findings show that there is no significant gender difference on participant performance on Abaninik psycho-neurological manual dexterity test (APMDT) The result also shows that there is significant difference on the performance of the participants in the five compartments of excellent performance, above average performance, average performance, below average performance, and very performance in Abaninik Psycho-Neurological manual dexterity test. The result also shows independent number and means of gender in the above five compartments of the new manual dexterity test. The standing of these five compartments were shown in graphical layout below. Recommendations were made among others that Future studies should examine inter-rater reliability, and other appropriate reliability indices. Evidence of content, construct, criterion-related, and predictive validity should also be established to determine the extent to which the test accurately measures manual dexterity and associated psycho-neurological functioning.

Keywords: *Construction, Validation, Psycho-Neurological, Manual Dexterity Test, Abaninik Psycho-Neurological Manual Dexterity Test.*

INTRODUCTION

Dexterity refers to the ability to use the hands efficiently and accurately to grasp, manipulate, and control objects. It is a complex motor function influenced by several factors, including hand development, muscle strength, range of motion, muscle tone, sensory function, and neuromuscular coordination. Consequently, the assessment of dexterity should consider these factors, as limitations in any of them may affect an individual's ability to perform functional hand movements.

Assessing dexterity in children, particularly those below three years of age, can be challenging because hand skills are still developing rapidly during early childhood. Fine-motor subscales included in developmental assessments, such as the Peabody Developmental Motor Scales, Second Edition (PDMS-2), may be useful for identifying developmental delays. However, more comprehensive assessments may be required when detailed information about hand function and specific manipulation skills is needed. One useful approach involves observing children as they interact with a standardized selection of toys and objects of different shapes, sizes, and textures. Such materials can be used to assess a variety of grasping and manipulation patterns. Where appropriate, comparing the performance of one hand or limb with the other may provide additional information about asymmetry or functional limitations. Repeated assessment with similar tasks and materials can also assist in monitoring changes in motor performance over time. During such assessments, safety must be given careful consideration, particularly when small objects are used with young children. Age-appropriate and safe materials should therefore be selected to reduce potential risks (Ashworth, 2024).

Several standardized instruments are available for the objective assessment of manual dexterity in children and other populations. These include the Functional Dexterity Test (FDT), the Box and Block Test, and the Nine-Hole Peg Test. The Functional Dexterity Test primarily assesses in-hand manipulation by requiring an individual to pick up, rotate, and place pegs into designated positions. Performance is typically evaluated according to the time taken to complete the task and errors or difficulties observed during administration. The Box and Block Test assesses gross manual dexterity by requiring an individual to transfer blocks from one compartment to another within a specified period. It can provide useful information about upper-limb motor performance, although adequate proximal control and the ability to grasp and release objects are necessary for successful completion of the task. Similarly, the Nine-Hole Peg Test is commonly used to assess fine manual dexterity and finger coordination. Beyond providing quantitative measures of performance, these standardized assessments allow clinicians and researchers to observe compensatory movements, coordination difficulties, and other functional limitations that may not be fully reflected in test scores alone.

In clinical and therapeutic research, blinding is an important methodological strategy for reducing bias and improving the validity of conclusions regarding the safety and effectiveness of an intervention. In a single-blind design, participants are unaware of the treatment or group to which they have been assigned, thereby helping to reduce expectancy and placebo-related effects. In a double-blind design, both participants and relevant investigators or assessors are unaware of treatment allocation, which can further reduce the influence of observer expectations and measurement bias.

Blinding is particularly important in research involving neurological and other clinical conditions where some outcome measures may involve subjective judgment or interpretation. By limiting the influence of expectations, blinding can strengthen the internal validity and credibility of study findings. Although the use of blinding is now widely recognized as an important component of rigorous clinical research, examining its historical development and early application in neurological research may provide valuable insight into the evolution of methodological practices designed to improve the reliability and validity of scientific evidence. Cognitive processes, including attention, memory, orientation, executive functioning, and decision-making, are essential for effective interaction with the environment and the successful performance of everyday activities (Lindberg et al., 2024). Following a cerebrovascular accident (stroke), however, individuals may experience a combination of cognitive, sensory, and motor impairments that affect functional independence and quality of life. Upper-limb impairments are among the most common consequences of stroke. These may include hemiparesis, reduced fine motor coordination, spasticity, muscle weakness, and sensory disturbances. Such impairments can significantly affect manual dexterity and reduce an individual's ability to grasp, manipulate, and control objects during daily activities (Kwakkel et al., 2023; Langhorne et al., 2011; Pennati et al., 2020; Santisteban et al., 2016).

Manual dexterity refers to the ability to perform precise, coordinated, and goal-directed movements of the hands and fingers. It is an important component of upper-limb function and is necessary for activities such as grasping, manipulating objects, writing, dressing, feeding, and performing occupational tasks. Upper-limb motor function, on the other hand, encompasses a broader range of abilities, including motor control, muscle strength, coordination, and movement of the shoulder, arm, wrist, and hand. Fine motor skills represent a specific aspect of upper-limb function involving small, accurate, and coordinated movements, particularly of the hands and fingers. The consequences of stroke vary considerably across individuals because neurological injury may produce different combinations and degrees of physical, cognitive, sensory, and emotional difficulties. Functional outcomes may therefore range from substantial recovery and independence to severe disability and dependence on others for daily activities (Perez-Cruzado et al., 2017). Occupational therapy plays an important role in the rehabilitation of individuals with stroke and other forms of acquired brain injury. Its primary objective is to promote functional independence, participation in meaningful activities, and the highest possible level of autonomy. To improve upper-limb function and manual dexterity, occupational therapists may employ interventions such as task-specific upper-limb training, fine motor exercises, bilateral coordination activities, sensory stimulation, assistive technologies, and, where appropriate, virtual reality-based rehabilitation. These interventions are typically tailored to the individual's functional limitations, rehabilitation goals, and clinical characteristics (Constantinovici et al., 2025).

From a neuroscientific perspective, the relationship between manual dexterity and cognitive functioning can be understood through the concepts of brain connectivity and neuroplasticity. Brain connectivity refers to the structural and functional interactions among different regions of the nervous system, while neuroplasticity describes the capacity of the brain to modify its structure and function in response to experience, learning, and rehabilitation. Repeated and meaningful motor practice may therefore contribute to the reorganization of neural networks involved in movement, sensory processing, and cognition.

The interaction between cognitive and motor processes is particularly important in stroke rehabilitation. Effective motor learning depends not only on physical practice but also on cognitive functions such as attention, working memory, planning, monitoring, and executive control. Difficulties in these areas may interfere with the acquisition, retention, and transfer of newly learned motor skills. Consequently, motor recovery should not be viewed solely as a physical process but as an outcome influenced by the interaction between neurological, cognitive, sensory, and environmental factors. Several theoretical perspectives provide a useful framework for understanding this relationship. The theory of embodied cognition emphasizes the close relationship between bodily action and cognitive processes. Similarly, the cognitive-motor interference theory proposes that cognitive and motor activities may compete for limited attentional and processing resources, particularly when they are performed simultaneously. Principles of task-oriented motor learning further emphasize the importance of repetitive, meaningful, and task-specific practice in promoting functional improvement and skill acquisition (Plummer et al., 2013; Shapiro & Spaulding, 2025; Mou & Jiang, 2025).

Beyond neurological rehabilitation, manual dexterity is also important in professional education and occupations that require precise hand movements. It involves the coordinated integration of visual information, motor control, finger movements, and hand–eye coordination. Consequently, manual dexterity is a central component of hand function and is particularly important in professions requiring accuracy and precision, including dentistry. In dentistry, effective clinical performance requires the ability to manipulate small instruments and materials with speed, precision, stability, and coordination. Manual dexterity is therefore regarded as an important skill for dental students and practitioners, particularly during preclinical training and the performance of restorative and other technical procedures (Lundergan et al., 2007; Dimitrijevic et al., 2011; Koo et al., 2025).

Several instruments have been used to assess manual dexterity. Among the commonly employed measures are the Purdue Pegboard Test, O'Connor Finger Dexterity Test, and the Minnesota Rate of Manipulation Test. Although these instruments provide standardized measures of general manual and finger dexterity, they were not specifically developed to assess the particular motor demands associated with dental procedures (Berger et al., 2009; Andersen et al., 2009; Yancosek & Howell, 2009). Recognizing the need for a more profession-specific assessment, Neves and colleagues developed the Dental Manual Dexterity Assessment, a relatively simple and reproducible method designed to evaluate manual dexterity among dental students within the context of restorative dentistry (Neves et al., 2020). Profession-specific assessments may provide more direct information about the relationship between students' motor abilities and their performance during preclinical dental activities.

The assessment of manual dexterity can therefore contribute to understanding the relationship between motor competence and performance in dental education. Such assessments may assist educators in identifying students who require additional practice or support and in evaluating changes in motor performance during training. However, relatively few studies have examined manual dexterity using instruments specifically designed for dentistry. This limitation makes it difficult to determine which assessment methods are most appropriate or predictive of performance in preclinical dental training (Lugassy et al., 2018; Urbankova & Engebretson, 2011). At the beginning of practical or preclinical training, many students may experience difficulties in performing tasks that require precise and coordinated hand movements. In restorative dentistry, for example, students may initially have limited manual dexterity and insufficient confidence in their ability to perform unfamiliar procedures. These challenges can affect their adaptation to practical training and may influence their subsequent performance (Gonzalez, Rowson, & Yoxall, 2015; Tuncer et al., 2015).

The development of manual dexterity is essential in dentistry and other occupations that require accurate, coordinated, and repetitive hand movements. However, inadequate development or assessment of these skills may contribute to reduced confidence and difficulties in acquiring practical competencies. Appropriate training, practice, supervision, and feedback are therefore important in helping individuals develop the level of manual control required for effective performance (Al Saud et al., 2017; Gonzalez et al., 2015; Neves et al., 2023). Because manual dexterity can influence task performance, productivity, and, in some professions, the quality and safety of services, early assessment may be useful in identifying individuals who require additional training or support. In educational settings, such assessment can help instructors provide targeted assistance to students with lower levels of manual dexterity. Similarly, in occupational and industrial environments, the assessment of manual skills may provide useful information about workers' ability to perform tasks that demand speed, coordination, precision, and effective hand control (Urbankova & Engebretson, 2011; Neves & Garcia, 2018).

Against this background, the present study seeks to examine the effectiveness of the Abaninik Psycho-Neurological Manual Dexterity Test, an indigenous instrument developed to assess manual dexterity, in evaluating workers whose occupations require efficient and coordinated use of the hands. The study is particularly relevant to employees in pharmaceutical and bottling companies, manufacturing industries, confectionery and textile industries, and other factory settings where workers perform tasks involving repetitive and precise hand movements. Such occupations may include activities such as sorting, assembling, packaging, sealing, corking, handling materials, and operating or manipulating work-related equipment. The Abaninik Psycho-Neurological Manual Dexterity Test may therefore provide a useful means of assessing workers' capacity for coordinated and effective hand movements that are relevant to their occupational responsibilities.

The findings of the study may contribute to the development of appropriate methods for assessing manual dexterity in occupational settings. In particular, the instrument may assist employers, researchers, occupational psychologists, and other relevant professionals in identifying variations in workers' manual performance and determining areas in which additional training or intervention may be beneficial.

LITERATURE REVIEW

Concept of Manual Dexterity

Manual dexterity refers to the ability to perform skilled, accurate, coordinated, and purposeful movements of the hands and fingers. It involves the integration of visual perception, hand–eye coordination, sensory feedback, motor control, and muscular coordination. Manual dexterity is particularly important in activities that require the manipulation of small objects, the use of tools, and the execution of precise or repetitive movements. Although manual dexterity has received considerable attention in dental education, its relevance extends beyond dentistry to several occupational and industrial settings. Workers in manufacturing, pharmaceutical production, bottling, packaging, textile production, and related industries frequently perform tasks that require speed, precision, coordination, and sustained control of hand movements. Deficiencies in these abilities may affect efficiency, accuracy, and successful task completion. pubmed.ncbi.nlm.nih.gov.

Assessment of Manual Dexterity

Several standardized instruments have been developed to assess manual dexterity. Commonly used measures include the Purdue Pegboard Test, the O'Connor Finger Dexterity Test, and the Minnesota Rate of Manipulation Test. These instruments have been used in clinical, educational, and occupational contexts to evaluate different aspects of hand and finger coordination, speed, and object manipulation. However, the suitability of a particular manual dexterity assessment may depend on the population being evaluated and the specific skills required in the relevant environment. Some instruments provide general measures of manual performance but may not adequately reflect the particular motor demands of specialized professions or occupations. In dental education, this limitation led to the development of more task-specific measures. For example, Neves and colleagues introduced the Dental Manual Dexterity Assessment, which was designed to evaluate manual skills within the context of restorative dentistry. The development of such profession-specific instruments demonstrates the importance of matching assessment procedures to the functional demands of the population under investigation. journaljammr.com

Manual Dexterity and Practical Performance

Manual dexterity is closely associated with the acquisition and performance of practical skills. Individuals with adequate hand–eye coordination and fine motor control may find it easier to perform tasks requiring precision and object manipulation. Nevertheless, manual dexterity represents only one of several factors that may influence occupational or professional performance. Experience, training, motivation, attention, visual abilities, task familiarity, and the quality of supervision may also contribute significantly to performance outcomes. In educational settings, early assessment of manual skills may help identify students who could benefit from additional practice and individualized support. Similarly, in occupational settings, the assessment of manual dexterity may provide useful information for training, skills development, job placement, and the evaluation of work-related motor performance. pubmed.ncbi.nlm.nih.gov.

Manual Dexterity in Occupational and Industrial Settings

Many industrial occupations require workers to use their hands efficiently and consistently. Employees may be expected to grasp, sort, assemble, package, seal, label, cork, or manipulate materials and equipment as part of their routine duties. The successful performance of these activities often depends on the integration of fine motor coordination, visual guidance, speed, accuracy, and sustained attention. Despite the importance of these abilities, the assessment of manual dexterity in occupational settings may require instruments that are appropriate to the cultural and work environment of the population being assessed. An indigenous assessment instrument may therefore offer additional value where it is developed and validated for the characteristics and functional demands of the population in which it is intended to be used. pubmed.ncbi.nlm.nih.gov.

Relevance of the Abaninik Psycho-Neurological Manual Dexterity Test

The Abaninik Psycho-Neurological Manual Dexterity Test (APDMT) is intended as an indigenous instrument for the assessment of manual dexterity. Its application may be particularly relevant to occupations and work environments in which effective hand coordination and object manipulation are essential components of job performance. The present study therefore focuses on examining the effectiveness and potential usefulness of the Abaninik Psycho-Neurological Manual Dexterity Test for assessing workers' capacity to perform coordinated and purposeful hand movements. Its application may be explored among employees in pharmaceutical, bottling, confectionery, textile, and other manufacturing or factory-based industries. By evaluating the usefulness of the instrument within occupational settings, the study may contribute to the development of culturally and contextually relevant approaches to the assessment of manual dexterity. It may also provide preliminary evidence regarding the potential role of the instrument in occupational assessment, skills evaluation, training, and research. pubmed.ncbi.nlm.nih.gov.

Manual dexterity is an important component of performance in many educational, professional, and occupational activities. While existing assessment instruments have contributed substantially to the evaluation of hand and finger coordination, there remains a need for assessment tools that are relevant to particular populations and functional environments. The Abaninik Psycho-Neurological Manual Dexterity Test has the potential to contribute to this area by providing an indigenous approach to the assessment of coordinated hand movements. Examining its effectiveness among workers in industries that require precise and repetitive manual activities may provide valuable information about its usefulness as an occupational assessment instrument. Further research should therefore establish its psychometric properties, including reliability, validity, normative values, and its relationship with relevant indicators of occupational performance. pubmed.ncbi.nlm.nih.gov.

Empirical Review

The scientific investigation of movement quality is complex because human movement is influenced by multiple physiological, cognitive, biomechanical, and environmental factors. A comprehensive understanding of movement quality therefore requires systematic information obtained from different sources and the application of appropriate methods for measuring and analysing human performance. Manual dexterity is generally understood as the ability to perform skilled, coordinated, and purposeful movements of the hands and fingers in the manipulation of objects. Earlier definitions primarily emphasized the capacity to manipulate objects efficiently with the hands (Aaron & Jansen, 1992). However, subsequent research has demonstrated that dexterity is a multidimensional ability that cannot be adequately explained by a single characteristic or measure. Studies of hand function have increasingly emphasized the importance of examining the actual movements involved in grasping, manipulating, and releasing objects. Because these activities form an important part of everyday functioning, the assessment of dexterity should include movements that reflect the demands of activities of daily living (ADLs). Such an approach provides a more realistic understanding of how individuals use their hands during functional activities.

Kinematic analysis has been used to provide objective information about the characteristics of human movement. By examining variables such as movement time, speed, trajectory, coordination, and movement variability, kinematic techniques can provide detailed information about the quality and efficiency of hand movements. These methods may therefore assist researchers in identifying movement patterns associated with effective performance during functional and manipulative tasks. Previous investigations have also explored different approaches to the collection and analysis of movement data. The selection of an appropriate assessment method is important because different tests may measure different aspects of hand function. Consequently, researchers often consider factors such as the purpose of the assessment, the characteristics of the population, the functional relevance of the task, and the availability of normative data when selecting an instrument for the evaluation of manual dexterity. Factor-analytic studies have provided further evidence that manual dexterity is not a unitary ability. Research involving large groups of participants has shown that dexterity consists of several related abilities and that performance may vary according to the nature and demands of a particular task (Buxton, 1938; Wittenborn, 1945; Fleishman & Hempel, 1954). Thus, an individual's performance on one manual task may not necessarily provide a complete representation of his or her overall manual capability. This task-dependent nature of dexterity suggests that a comprehensive assessment should consider several dimensions of hand function. Previous research on hand–object interaction has identified cognition, muscular strength, and dexterity as important factors influencing manual performance (Yoxall et al., 2007; Lee & Newell, 2012). These factors interact during the execution of purposeful movements and may collectively determine an individual's ability to manipulate objects successfully.

Cognition plays an important role in the successful performance of manual activities. It involves several mental processes, including attention, memory, learning, language, reasoning, problem-solving, and decision-making (Sternberg & Sternberg, 2012). Within the context of manual performance, cognition may be broadly understood as the processing of information required for planning, initiating, monitoring, and adjusting movements during the performance of a task (Blomberg, 2011). Effective hand function therefore depends not only on muscular and motor capabilities but also on the ability to perceive relevant information, select an appropriate response, and adapt movement to changing task demands. Cognitive limitations may consequently affect the planning and execution of manual activities, particularly when tasks are unfamiliar, complex, or require rapid decision-making.

Manual performance is also influenced by learning and previous experience. Repeated practice can contribute to the development and refinement of motor skills, enabling individuals to perform movements with greater efficiency, coordination, and adaptability. Latash and Turvey (1996) emphasized the importance of experience and skill acquisition in the development of motor performance, particularly in an individual's ability to respond to changing or unexpected motor demands. The effects of learning must therefore be considered when evaluating manual dexterity. Performance on a manual task may improve as an individual becomes more familiar with the activity and develops new movement strategies. Consequently, repeated exposure to an assessment task may influence performance independently of an individual's underlying level of dexterity. Researchers should therefore consider practice effects when designing and interpreting studies involving manual tasks.

Muscular strength is another important factor associated with hand function. Adequate strength may be necessary for grasping, holding, and manipulating objects, particularly when tasks involve resistance or sustained force. Nevertheless, strength alone does not fully explain successful manipulative performance. An individual may possess sufficient muscular strength but still experience difficulty performing tasks that require precision, timing, coordination, and rapid adjustment of movement.

The distinction between strength and dexterity is particularly important in the assessment of hand function. While strength refers primarily to the capacity to exert force, dexterity involves the controlled and coordinated use of movement to achieve a specific goal. A comprehensive assessment of hand performance should therefore consider both the capacity to generate force and the ability to use the hands accurately and efficiently. Although considerable research has examined hand strength, cognition, learning, and their influence on hand–object interactions, further investigation is required to clarify the specific characteristics and limitations of manual dexterity. A better understanding of dexterity may contribute to the development of more appropriate assessment instruments, therapeutic interventions, and rehabilitation programmes for individuals experiencing limitations in hand function (Vanbellingen, 2011; von Hofsten, 1991).

A clear understanding of manual dexterity has important implications beyond clinical assessment. In rehabilitation, accurate knowledge of an individual's hand function can assist professionals in identifying specific areas of difficulty and developing interventions that address relevant motor limitations. Improved assessment methods may also support the monitoring of treatment outcomes and changes in functional performance over time. Manual dexterity is equally relevant to the design of products, tools, and services. When the functional capabilities and limitations of users are not adequately considered during the design process, some individuals may experience difficulties accessing or effectively using products that are important for work, independence, and everyday life. Human-centred and inclusive design approaches therefore require careful consideration of the diversity of human hand function and manipulative ability (Pennathur et al., 2003; Yoxall et al., 2007; Yoxall, Rodriguez-Falomir, & Luxmoore, 2013; Keates et al., 2000).

Summary of Literature

The reviewed literature indicates that manual dexterity is a complex and multidimensional aspect of human functioning. It is influenced by several interrelated factors, including motor control, muscular strength, cognitive processing, learning, previous experience, and the specific demands of a task. The task-dependent nature of dexterity further suggests that no single assessment may fully capture all aspects of hand function. Objective approaches, including kinematic analysis and standardized dexterity assessments, may provide valuable information about the quality, coordination, and efficiency of hand movements. However, continued research is necessary to develop assessment methods that adequately reflect functional hand use within specific clinical, occupational, and cultural contexts. Such research is particularly relevant to the evaluation and further development of indigenous instruments, including the Abaninik Psycho-Neurological Manual Dexterity Test, for assessing manual dexterity and functional hand performance.

Statement of the Problem

Most of the time, people take for granted the trembling nature of their hands. The trembling hands or limbs may be as a result of excessive intake of alcohol beverages. Excessive intake of alcohol beverages may affect the human nerve and lead to its break down. Apart from neurological diagnosis by medical experts (Neurologists), there are no known standardized psychological instruments that can be employed to assess and discriminate against individuals who manifest early signs of trembling or shaky hands.

Secondly, there are also no known standardized instruments for the selection and placement of workers in the factories and companies, more especially the workers who work with their hands. For instance, workers who are selected and placed to work in pharmaceutical companies, bottling companies and textile factories. The study (manual dexterity project) will be designed and fabricated to assess and discriminate against patients and participants who may manifest early sign of neural breakdowm (parkinsonism). The Study (manual dexterity project) will also be designed and fabricated to be used in selection and placement in factories and companies. The manual dexterity device will be basically used to employ workers that work exclusively with their hands. For instance, workers that will be selected and placed to work in the pharmaceutical companies, bottling companies, and textile companies (Abamara, 2025).

Against this backdrop, two hypotheses were postulated to guide this study/project, and they are as follows:

1. Male participant will perform better in the Abaninik psycho-neurological manual dexterity test than the female participants.
2. Participants will significantly perform differently across four compartments of Abaninik psycho-neurological manual dexterity test.

METHOLOGY

Participants:

A total of four hundred (400) participants were selected for the construction of the Abaninik Psycho-Neurological manual dexterity test. The participants were selected from five Organisations in the capital city of three states in the Southeast geopolitical zone, namely Awka, Owerri, and Enugu. Their age range ranged from 20 to 60 years with a mean age of 40 and a standard deviation of 28.2.

Instrument:

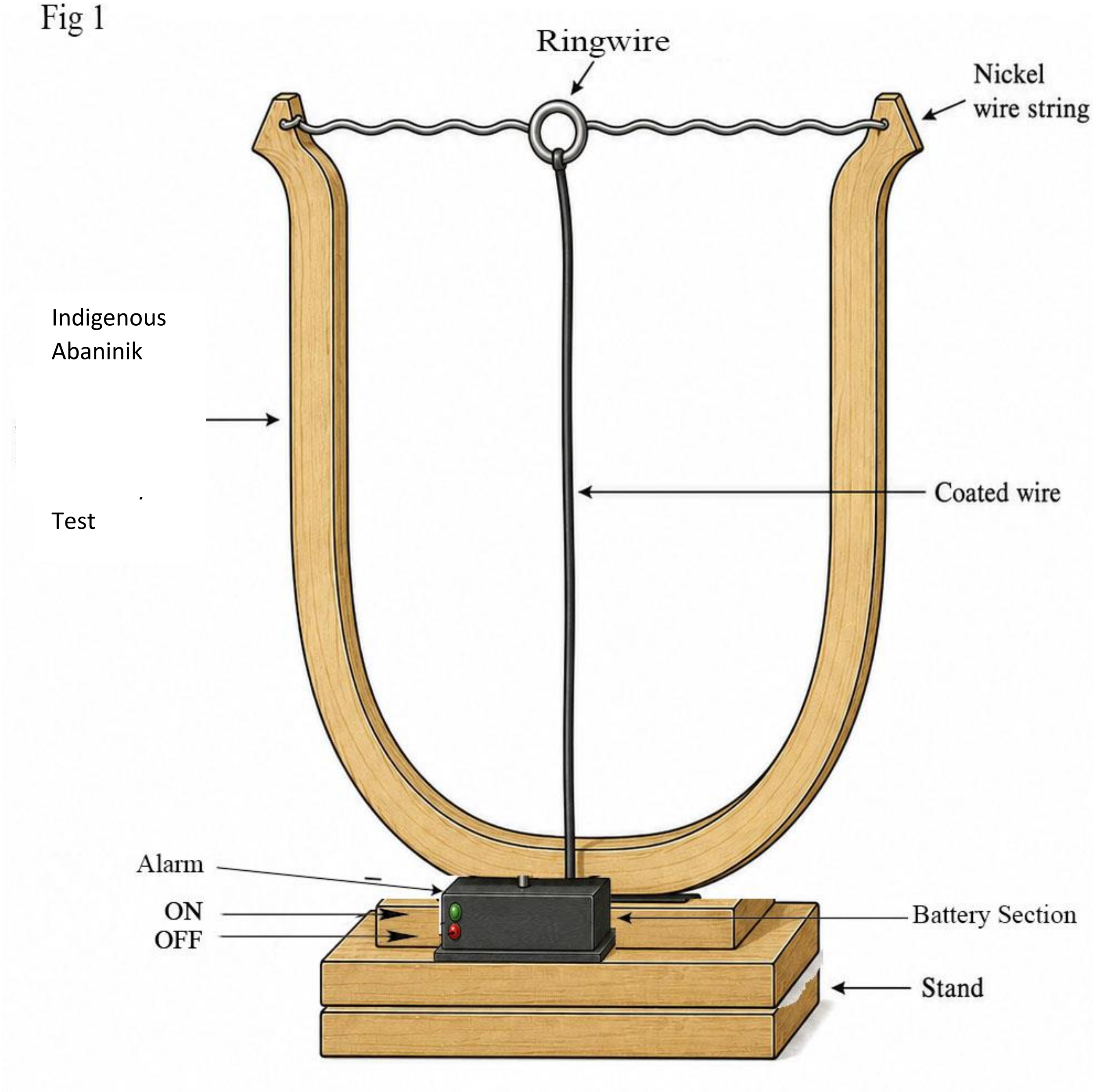
The researchers constructed a psycho-neurological manual dexterity test called Abaninik Psycho-Neurological Test (an indigenous manual dexterity test) that was utilized to assess and test the early signs of neurological disorders in clients or patients. The manual dexterity test was also utilized in the selection and placement of Factory or company workers where they have comparative advantage to perform satisfactorily. It could be used to select factory or company workers who will be predominantly working with their hands. The instrument will be in the bow-shape format, with a standing base that has a battery unit and an off switch. It will have a wire string from one end of the bow arrow to another, and a small circle of wire connected to a long wire that will be attached to the battery based semi-conductor device.

Procedure:

The researchers constructed an indigenous manual dexterity text that was named Abaninik Psycho-neurological Manual Dexterity, (ABANINIK) is an acronym for the names of the Authors of this project. The Manual dexterity test composed of a bow-shaped or ark with an aluminum insulator that will rest on a stand harboring a battery unit/device that has an on-and-off switch. The bow will have a wire from one end to another, the wire is basically to send alarm signals at the touch of a round ring wire that has a coated wire connected to the battery unit. This manual dexterity device, is fabricated to detect the early signs of neurological breakdown (Parkinson's disease) in patients. It is also useful in the selection and placement of workers in the factories and companies, more especially the workers who work with their hands in factories such as wire cables production, textile companies, pharmaceuticals, and bottling companies. The researchers will employed the services of an electrical technologist to assist in wiring and connecting the electrical devices of the new manual dexterity test.

The drawing prototype of the manual dexterity test is shown below in Fig 1.

Fig 1



Interpretation

Abaninik Psycho-Neurological Manual Dexterity Test (An Indigenous Manual Dexterity Test). was developed by Abamara et al 2026). It is fabricated in a bow ark like proto-type polished wood on a two-step wooden stand. It has a nickel wire string that stretches from one corner of the arc to another, with a naked ring wire around the nickel wire string. The naked ring wire has an extended coated wire connected to an electrical device attached to the stand base of the arc. The electrical device on the arc contains battery cells that power the manual dexterity test with on/off switch indicators. The nickel wire string from one end of the arc to the other is about two feet wide, and when the device is on, the testees are supposed to move the wire meticulously from one end to the other. Any touch within the circumference of the ring wire will trigger the alarm, indicating that the testees have defaulted. The number of touches that trigger the alarm shows how many times the testees have failed while moving the wire across the nickel wire. The first-order touches by the testees are designated as excellent performance; the second-order touches by the testees are designated as above average performance; the third-order touches by the testees are designated as average performance; the fourth-order touches by the testees are designated as below average performance; and finally, the fifth-order touches by the testees are designated as very poor performance. The dimensions of the bow-like arc prototype Abanink psycho-neurological manual dexterity test are 2 feet in height, two feet from one end of the arc to another, with 2 feet of coated wire that terminates at the ring wire that connects to the 3 inches semi-conductor electrical device. The two-step stand is a rectangular 1-foot stand.

Objectives of the Manual Dexterity Test

The Abaninik Psycho-neurological Manual Dexterity Test (APDMT) is designed to screen workers in factories or companies such as bottling companions, pharmaceutical companies, textile companies and wire cable companies who can competently work with their hands at an appreciable speed. It is specially designed to screen and place workers who work in the corking section of the factories. In the factory section of the company, where they use simple machines to cork bottled drinks or water, or cork bottles or plastic pharmaceutical drugs. The Abaninik Manual Dexterity test is also designed to screen patients or clients who have the risk of developing Parkinsonism or neural breakdown at the early and adult age of their life.

Design/Statistics

The study (project) will adopt between subjects and independent group designs. A statistical tool One-way ANOVA and T-test of independent design was employed to manage the data responses of the participants of this research.

Reliability, Validity and Norms for Categorization

The pilot study of 120 participants was conducted, and the result of the test-retest reliability coefficient stood at .92. For the validity, the researchers, the researchers adopted face validity for the new Abaninik Psycho-neurological manual dexterity test. The new manual dexterity instrument was sent to manual dexterity experts in six Universities within the country, and they verified and found out that the new manual dexterity test was superficially measuring what it was constructed to measure.

The norm for categorization was determined by a pilot study that will be conducted with one hundred and twenty participants drawn from a coca cola bootling Company in Aba, Abia State other than the capital cities of the Southeast states that will be used for the main study. The norms obtained from the pilot study was used to determine the performance of the participants in the manual dexterity test. The performance of the participants in the pilot study was used to determine the performance categorization of would-be testees of the new Abaninik Psycho-Neurological manual dexterity test. The categorization was designated as excellent performance, above average performance, average performance, below average performance, and very poor performance. This was basically to determine the reliability and validity of the new manual dexterity test that will be named (ABANINIK) manual dexterity test. The norm for selection for excellent performance stood at 2.5. The norm for selection for above average performance stood at 4.5. The norm for selection for average performance stood was 6.5. The norm for selection for below average performance stood at 8.5, and finally the norm for selection for very poor performance stood at 10.5.

Table 1: The Mean and Standard Deviation of the main Score of Abaninik Manual Dexterity Test (An indigenous Manual Dexterity Test) in Five Compartments

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Gender	80	1.00	2.00	1.4500	.50063
ExcellentPerf	80	1.00	3.00	1.9500	.79396
AboveAveragePerf	80	3.00	6.00	4.3500	1.05662
AveragePerf	80	3.00	7.00	5.2250	1.10207
BelowAveragePerf	80	5.00	9.00	6.9000	1.18642
VeryPoorPerf	80	7.00	10.00	8.6125	.93448
AbaninikManualDexterityTest	80	1.00	10.00	5.5000	2.89040
Valid N (listwise)	80				

The table 1 above shows the descriptive means and standard deviations of five compartments of excellent performance, above average performance, average performance, below average performance and very poor performance on Abaninik Psycho-Neurological Manual dexterity test.

Table 2: One-Way Analysis of Variance (ANOVA) of the main Scores of Abaninik Manual Dexterity Test (An Indigenous Manual Dexterity Test) in Five Compartments

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Gender	Between Groups	1.300	9	.144	.547	.835
	Within Groups	18.500	70	.264		
	Total	19.800	79			
ExcellentPerf	Between Groups	8.050	9	.894	1.500	.165
	Within Groups	41.750	70	.596		
	Total	49.800	79			
AboveAveragePerf	Between Groups	7.450	9	.828	.718	.691
	Within Groups	80.750	70	1.154		
	Total	88.200	79			
AveragePerf	Between Groups	8.200	9	.911	.727	.683
	Within Groups	87.750	70	1.254		
	Total	95.950	79			
BelowAveragePerf	Between Groups	10.950	9	1.217	.850	.574
	Within Groups	100.250	70	1.432		
	Total	111.200	79			
VeryPoorPerf	Between Groups	4.862	9	.540	.590	.801
	Within Groups	64.125	70	.916		
	Total	68.988	79			

Findings:

The result shows no significant gender (male and female difference at F (9, 79) =.547; P .835 in the performance of the Abaninik Psycho-Neurological Manual Dexterity test.

The result shows no significant difference in excellent performance among participants that fall within this category. F (9,79) =1.500; P.165.

The result shows no significant difference in above-average performance among participants that fall within this category. F (9, 79) =.718; P.691.

The result shows no significant difference in average performance among participants that fall within this category. F (9,79) =.727; P.683

The results show no significant difference in below-average performance among participants who fall within this category. F (9,79) = .850; P.574.

The result shows no significant difference in very poor performance among participants who fall within this category. F (9,79) = .590; P.801.

THE RESULT

Table 3: T-Test of Independent Samples Showing the Contributions of Gender in five Compartment of Abaninik Manual Dexterity Test (An Indigenous Manual Dexterity Test)

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
ExcellentPerf	Male	44	1.9545	.77623	.11702
	Female	36	1.9444	.82616	.13769
AboveAveragePerf	Male	44	4.4318	1.06526	.16059
	Female	36	4.2500	1.05221	.17537
AveragePerf	Male	44	5.2955	1.04725	.15788
	Female	36	5.1389	1.17480	.19580
BelowAveragePerf	Male	44	6.8636	1.13283	.17078
	Female	36	6.9444	1.26366	.21061
VeryPoorPerf	Male	44	8.6818	.85651	.12912
	Female	36	8.5278	1.02779	.17130
AbaninikManualDexterityTest	Male	44	5.4773	2.97656	.44873
	Female	36	5.5278	2.82323	.47054

The result in Table 3 shows that female participants performed better than males in the excellent performance category of the Abaninik Psycho-Neurological Manual Dexterity test. (Mean: Male=1.9545, Female=1.9444).
The female participants performed better than male participants in the above-average performance category of the Abaninik Psycho-Neurological Manual Dexterity test. (Mean: Male=4.4318, Female= 4.2500).
The female participants performed better than male participants in the average performance category of the Abaninik Psycho-Neurological Manual Dexterity test. (Mean: Male: 5.2955, Female: 5.1389).
The male participants performed better than female participants in the below-average performance category of the Abaninik Psycho-Neurological Manual Dexterity test. (Mean: Male: 6.8636, Female: =6.9444).
Finally, female participants performed better than male participants in the very poor performance category of the Abaninik Psycho-Neurological Manual Dexterity test. (Mean: Male: 8.8813, Female: 8.5278).

In overall performance, female performed better than male participants in Abaninik Psycho-neurological Manual Dexterity test with the standard error mean for male= .44873 and the standard error mean for female =.47054.

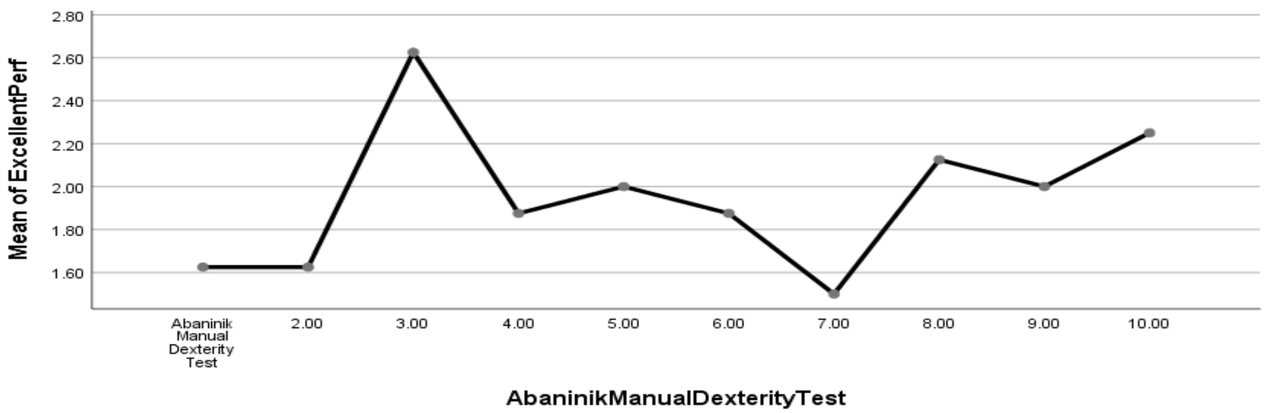
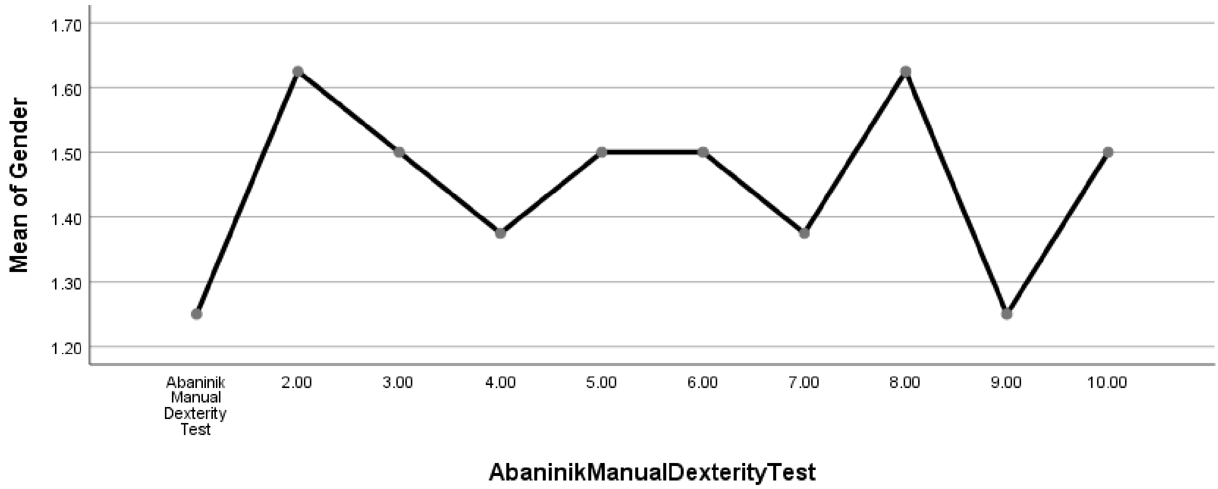
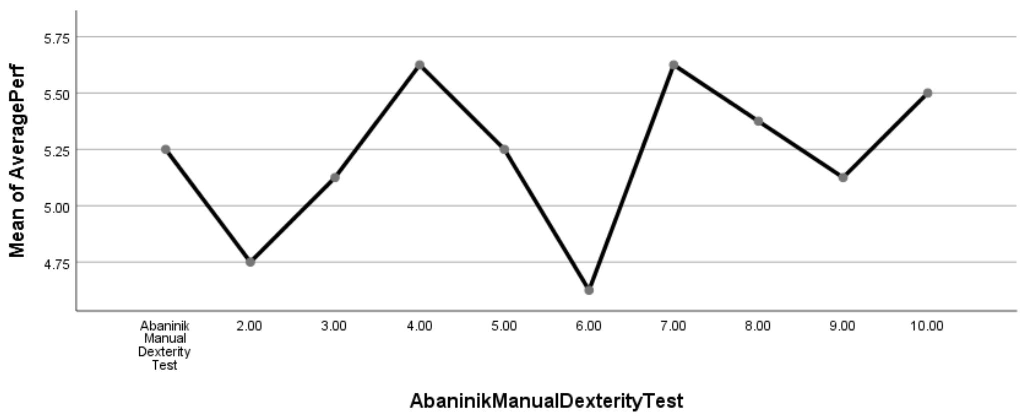
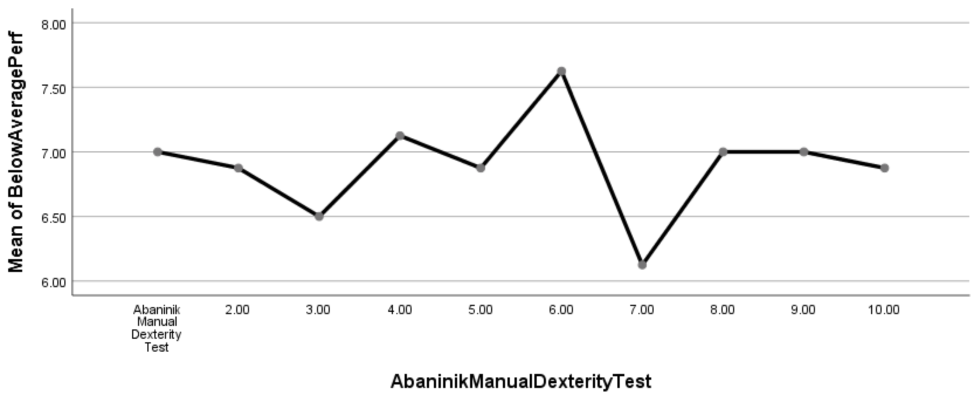
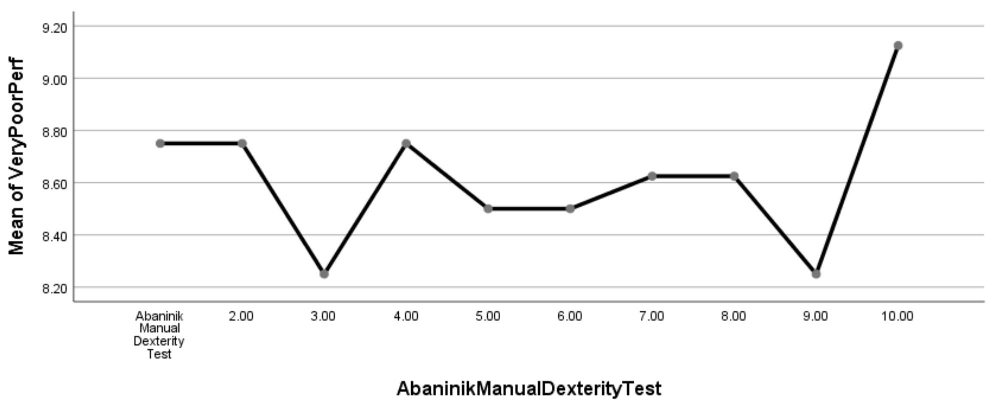


Fig: 2: Graphs on five compartments of excellent performance, above average performance, average performance, below average performance and very poor performance on Abaninik Psycho-Neurological Manual dexterity test.


Mean of Gender
1.70
1.60
1.50
1.40
1.30
1.20
Abaninik Manual Dexterity Test
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
AbaninikManualDexterityTest


Mean of AveragePerf
5.75
5.50
5.25
5.00
4.75
Abaninik Manual Dexterity Test
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
AbaninikManualDexterityTest





DISCUSSION

Abaninik Psycho-neurological Manual Dexterity Test (an indigenous manual dexterity test) was fabricated, developed, validated, and standardized using samples from the main population in eastern Nigeria. The results of the main population show that there is no significant difference in the performance of the Abaninik manual dexterity test across genders.The independent-samples t-test shows that female participants performed better than male participants across the five mean compartments of excellent performance, above average performance, average performance, below average performance, and very poor performance. The normative and clinical studies establish that women consistently outperform men on task requiring the motor skills, small object manipulation, and rapid finger dexterity (Mathiowetz et al., 1985; Pavlinac Dodig et al., 2020). For example, standardized normative testing on the Nine Hole Peg Test showed that female participants completed tasks significantly faster than male participants across diverse age groups (Mathiowetz et al., 1985). It is also evident that evaluation across multiple dexterity assessments demonstrates that while men often demonstrate greater whole-hand grip strength, women outperform men on tests requiring precise coordination, such as placing pins on the Purdue Pegboard Test (Wunderle et al., 2024).

Analysis of fine motor precision tasks indicates that sex-related differences in dexterity remain consistent across visual and non-visual feedback conditions, with females showing advantages in fine motor precision and guidance tasks across different age groups (Liutsko et al., 2020). Physiological studies analyzing motor performance report distinct sensorimotor strategies between genders, including differences in muscle activation and movement patterns when performing sustained manual dexterity tasks (Minn & Cote, 2018). The result further shows that there is no significant difference in performance of participants that had excellent performance, but the result in this category shows that 50 participants recorded excellent performance in the Abaninik psycho-neurological manual dexterity test. There is no significant difference between participants who recorded above-average performance in the Abaninik psycho-neurological manual dexterity test. A total of 88 participants scored above-average in the new manual dexterity test.

There is no significant difference among participants who recorded average performance in the Abaninik psycho-neurological manual dexterity test, but a total of 96 participants scored on average on the new manual dexterity test. There is no significant difference among participants who recorded below-average performance in the Abaninik psycho-neurological manual dexterity test, but a total of 79 participants scored below average in the performance of the new manual dexterity test.

Finally, there is no significant difference among participants who recorded very poor performance in the Abaninik psycho-neurological manual dexterity test, but a total of 69 participants recorded poor performance in the new manual dexterity test.

The overall, result shows no significant performance of participants across the above five compartments. The findings are in line with the argument that standardized evaluation frameworks applied in the assessment of participant performance in Abaninik psycho-neurological manual dexterity test showed statistical equivalent across categorized group. Studies in performance analysis and assessment indicate that when tasks are standardized or when participants possess similar baseline training, variance between artificially divided performance tiers from a “very poor” to “excellent” fails to reach statistical significance. This lack of variance suggests that categorized performance distinction may reflect subjective grading boundaries rather than meaningful differences in underlying capability (Schmidt & Hunter, 2025; Williams et al., 2021). Furthermore, recent empirical evaluation of participants demonstrates that post-hoc performance stratification often yields p-values above the standard significant threshold, conforming no significant main effect across performance categories (Chen & Liu, 2023). In overall female participants performed better than male participants in the Abaninik psycho-neurological test and this stems from the standard error mean difference which shows the mean error of female participant are less than the mean error of male participants.

Recommendations

1. It is recommended that further empirical studies be conducted to establish the reliability and validity of the New Abaninik Psycho-neurological Manual Dexterity Test. Future studies should

examine test–retest reliability, inter-rater reliability, and other appropriate reliability indices. Evidence of content, construct, criterion-related, and predictive validity should also be established to determine the extent to which the test accurately measures manual dexterity and associated psycho-neurological functioning.

2. There is a need to develop extensive normative data for the New Abaninik Test using larger and more representative samples. Norms should, where appropriate, take account of variables such as age, sex, educational background, occupational experience, and geographical location. This would make interpretation of individual test scores more accurate and would improve the usefulness of the instrument among different Nigerian populations.

3.Relevant professionals should be adequately trained in the administration, scoring, and interpretation of the New Abaninik Psycho-neurological Manual Dexterity Test. A detailed administration and scoring manual should be developed to ensure that the test is administered under standardized conditions. This will help minimize examiner-related errors and improve consistency in the use of the instrument across different clinical, educational, and research settings.

4.The test should be further investigated for application in clinical psychology, neuropsychology, occupational therapy, rehabilitation, educational assessment, and related areas. Researchers and practitioners should explore its usefulness in assessing manual dexterity among individuals with neurological or neuropsychological difficulties, as well as in monitoring changes in performance during rehabilitation and intervention. Such applications would provide additional evidence concerning the practical value of the indigenous instrument.

5.The New Abaninik Psycho-neurological Manual Dexterity Test should be subjected to continuous research, review, and refinement. Feedback from psychologists, neuropsychologists, occupational therapists, researchers, and other trained users should be considered in improving the test items, instructions, scoring procedures, and administration process. Further research should also examine its applicability across different Nigerian cultural and linguistic groups and determine whether the instrument remains sensitive, practical, and culturally appropriate as its use expands.

Conflict of Interest:

The authors hereby declare that there is no conflict of interest.

Data Availability Statement: *The data supporting this study will be provided by the authors upon request.*

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