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EFFECTIVENESS OF A CUSTOMIZED PHYSICAL TRAINING PROGRAM FOR IMPROVING UPPER-BODY STRENGTH IN STUDENTS WITH PHYSICAL DISABILITIES

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ABSTRACT

The current research study has investigated the effectiveness of a tailored physical training program to enhance upper-body muscular strength on students with physical disabilities. A quantitative research approach with single subject experimental research design ABA was used to carry out the research. A purposive sampling technique was applied to select 05 students aged 10-17 years with physical disabilities from (PSRD) Pakistan Society for Rehabilitation of Differently Abled School. For the confirmation of diagnosis of Upper Body weakness in all 5 students Manual Muscle Testing (MMT) was used by the researchers with the help of physio therapist. To determine the baseline The Brockport Bench Press Test was used to test upper-body muscular strength. A customized physical training program was applied for 12 weeks 05 days a week. Then again Post assessment was done with the same as The Brockport Bench Press Test. The analysis of data was performed with the help of computer software for social sciences, the visual analysis shown in line graphs. The results showed statistically significant increases in upper-body muscular strength after the individualized physical training program. The findings demonstrate the usefulness of MMT-guided need-based and individualized training interventions in improving upper-body functional performance and strength in students with physical disabilities. The findings aid the introduction of tailored physical training in school-based rehabilitation and physical education to meet different functional requirements.

Keywords: *Improve upper-body strength; Customized physical training; Students with physical disabilities; Manual Muscle Testing (MMT); Brockport Bench Press Test; Need-based training.*

INTRODUCTION

The muscular strength of the upper body is one of the primary predictors of functional independence and mobility among students with physical disabilities as well as physical performance. (Özkan et al., 2024). Good upper-body strength helps one to carry on with the necessary everyday activities like transfers, self-care, handling objects and engaging in education and recreational activities (Rybski, 2024). In the case of physically impaired students, upper-limb weakness can be a major constraint of functional capacity and opportunities to actively engage in school-based physical education programs (Cox, 2024).

This may negatively affect the level of physical activity because of neurological, musculoskeletal, or congenital conditions that cause reduced muscular strength in students with physical disabilities, causing secondary health problems (Legerlotz, 2020). The traditional physical training programs are usually tailored to the able population and may

not sufficiently cater to the different functional requirements of students with physical disabilities (Jamieson, & Wijesundara, 2025). Therefore, physical training programs based on individual capabilities and functional requirements were in high demand as specialized and requirement-oriented programs (Lisenchuk et al 2023).

Manual Muscle Testing (MMT) usually serves to measure muscle strength and detect particular weaknesses, which forms a sensible basis of creating an individual training intervention. MMT, used with standardized measures of fitness like Brockport Bench Press Test, enables a thorough assessment of upper body muscular strength in students with physical disabilities (Avers & Brown, 2024). The Brockport Physical Fitness Test is specifically designed in relation to youth with disabilities, and is well-known in relation to its usage in the school-based and adaptive physical education (Beach et al., 2024). In spite of the mentioned previous studies that have emphasized the benefits of strength training on individuals with disabilities, there is still limited research that has reviewed the efficacy of tailor-made, need-based physical training programs supposed to enhance upper-body strength in school-aged students with physical disabilities especially in a developing country set up (Bradley et al., 2025). In addition, no empirical data has been found to combine clinical assessment instruments like MMT and standardized outcome measures of strength to school-based intervention (Johnsen et al., 2024). Thus, the aim of the current research was to analyze the efficiency of the designed physical training program focused on enhancing the upper-body muscular strength in students with physical disabilities (Mufarrej et al 2025). Through the use of MMT to inform personalized training and use of Brockport Bench Press Test to measure the results of strength, this study would help provide evidence to support the use of personalized physical training programs in special education and adaptive physical education environment (Chokphukiao et al., 2023).

Significance of the Study

This research is important because it gives evidence concerning effectiveness of a tailor-made, need-based physical training program on enhancing the upper-body strength among students with physical disabilities. Through a combination of Manual Muscle Testing with Brockport Bench Press Test, the paper validates personalized measurement and treatment in school. The results will help to adapt physical education and rehabilitation to improve the functioning of students with physical disabilities, their level of independence, and their involvement by encouraging individual training strategies.

Research Objectives

1. To confirm the diagnosis of upper-body muscular strength or weakness among students with physical disabilities using Manual Muscle Testing (MMT).
2. To design and implement a customized, need-based physical training program based on individual strength and functional needs.
3. To evaluate upper-body muscular strength using the Brockport Bench Press Test.
4. To examine the effectiveness of the customized physical training program in improving upper-body strength among students with physical disabilities.
5. To analyze differences in upper-body strength outcomes using appropriate non-parametric statistical methods.

Literature Review

The functional independence, mobility, and involvement in the activities of students with physical disabilities depend on the upper-body muscular strength. The sufficient upper-limb strength allows executing such tasks as the transfer, self-care, objects in hands, and performing school-based activities that are usually limited in children and adolescents with physical impairments (Nawge & Karthikbabu 2023). Impaired muscle strength in the upper limbs may limit physical activity, lead to secondary health care problems, including muscle deformity and fatigue, and have a poor effect on the overall quality of life (O'Connell et al., 2025).

The tailored and need-specific physical training has also come out as a very important measure to overcome these constraints. In contrast to generalized models of exercise, individual training interventions are proposed depending on the functional capacity of a participant,

strength level, and the needs to do daily activities. These programs have been reported to be more effective in enhancing muscular strength, endurance and motor functioning of children and adolescents with disabilities (Beutel, 2025). Research shows that training programs guided by own needs can lead to improvement in performance of both functional and structured tests, which stimulate a person to become more independent and active (Rodrigues et al., 2025).

Proper evaluation of muscular strength is important in development of effective training programs. Manual Muscle Testing (MMT) is considered the common tool of assessing baseline muscle strength and recognizing particular weaknesses, which are used as the basis of need-based exercise interventions (Avers & Brown, 2024). The Brockport Physical Fitness Test (BPFT) which includes the Bench Press Test among the others is a standardized test that presents objective and valid results of upper body strength in young people with disabilities. The existing studies have shown that Brockport-directed strength training programs result in a significant increase in muscular performance and functional outcome (Gholami et al., 2025).

Even though there are proven advantages of strength training, the majority of the researches have concerned the general fitness results or adult groups. Limited studies on school-based, individualized interventions aimed at upper body strength in children with disabilities and adolescents particularly in developing countries exist (Stensvold et al., 2020). Additionally, the combination of clinical measures such as MMT and general intervention measures such as the Brockport Bench Press Test has not been done thoroughly in a systematic intervention framework (Kennerley, 2023). This gap inhibits the evidence-based directions to guide the adaptive physical education and rehabilitation programs at schools.

The research intends to fill this gap, and it will do so by applying a tailor-made, need-based physical training program that is informed by MMT tests and assessed using Brockport Bench Press Test. The study will serve to offer empirical support on the applicability of individualized training among physical disability students to enhance the strength of the upper body, functional independence, and facilitate the inclusion of physical education practices within a school setting Grimminger-Seidensticker & Seyda, 2022). It is hoped that the results will be useful to teachers, physical therapists, and policymakers in terms of how to practically consider the use of customized interventions of strength training to be integrated into school-based rehabilitation and adaptive physical education programs.

Methodology

The research design used in this study was a quantitative, single subject experimental research that was used to understand the effectiveness of a tailor-made physical training program on upper-body strength among the students with physical disabilities. The study was carried out at the (PSRD) Pakistan Society for Rehabilitation of Differently Abled School. that has adaptive physical education services. Of the 05 students aged 10-17 years, a purposive sample was then chosen so that the participants were young and could safely engage in upper-body exercises. Manual Muscle Testing (MMT) was used to measure the baseline strength and functional limitations and directed the implementation of need-based training programs that focused on the major upper-limb muscles individually. It was done three times a week under supervision and upper body strength assessed before and after training through the Brockport Bench Press Test. The data was examined with the help of SPSS. The analysis of data was performed with the help of computer software for social sciences, the visual analysis shown in line graphs.

Research Design

A quantitative research approach with single subject experimental research design ABA was used to carry out the research.

Population and sample of the Study.

Purposive sampling was employed in the study to pick a total of 20 students in the age group of 10-17 years of PSRD School. 05 Students with physical disabilities were included in the sample, which is an expression of a combination of functional abilities. The inclusion criteria were used to select the participants in such a way that they could comfortably engage in upper-body exercises and take part in the tailored physical

training program. This was considered a good sample size to conduct a comparative analysis of data using non-parametric statistics.

Research Instrument

As the main research tool to measure muscular strength of the upper body of students with physical disabilities, Brockport Bench Press Test was used. It is a test that is reliable and standardized and gauges on the number of correct repetitions on the bench press put in by the participants. This tool could be used to provide objective assessment of upper-limb strength pre, post and during the individualized physical training program, which revealed the effectiveness of the program clearly.

Intervention plan (ABA Design) Implementation Procedure.

The experiment was based on the single-subject ABA experimental design conducted in 12 weeks to determine the effectiveness of an individualized physical training program in enhancing upper-body strength. The plan was designed to measure initial upper-limb strength in the period of 2- weeks baseline (A1), an 8-week period of intervention (B) in which a need-based, supervised training program involving upper-limb muscles was implemented, and a 2-week period of withdrawal (A2) to measure the maintenance of the strength gains after the program was discontinued. The Brockport Bench Press Test was used to assess upper-body strength at intervals so that it could be compared during the base line period, intervention and withdrawal to check the effectiveness and sustainability of the training program.

Data Analysis and Interpretation.

Analysis of data was done with the help of computer software. To summarize the upper-body strength scores of the participants, descriptive statistics, such as the means and standard deviations were obtained. Optimization of the strength through pre- and post-intervention scoring of Brockport Bench Press Test made it possible to evaluate the effectiveness and sustainability of the tailor-made physical training program. The analysis of data was performed with the help of computer software for social sciences, the visual analysis shown in line graphs. Results were utilized to experience the practical implications of the need-based strength training among students with physical disabilities.

Table: 01 "Analyzing of Student-1 scores on the Brookport Bench Press Test"

Phase of study	Pairs	Tau-U	Z	P	90%CI
Baseline vs Intervention	144	0.9931	< 3.7071	0.0002	0.552 - 1.00
Intervention vs Withdraw	144	-1.5278	< -5.7032	0.0000	-1.00 - 1. 00
Baseline vs Withdraw	36	0.9931	< 3.7071	0.0002	0.552 – 1.00

Table 01 the Baseline vs Intervention comparison showed a very strong positive effect (Tau-U = 0.993, Z = 3.71, p = 0.0002; 90% CI: 0.552–1.00), indicating a significant and reliable improvement in upper-limb muscular strength following the intervention. This proves that the training program was very useful.

The Intervention vs Withdrawal comparison disclosed a limited negative effect (Tau-U = −1.528, Z = −5.70, p < 0.001; 90% CI: −1.00–1.00), displaying a weakening in execution afterwards the intervention was quiet, suggesting that some of the improvements were dependent on continued training.

The Baseline vs Withdrawal comparison presented a very strong positive effect (Tau-U = 0.993, Z = 3.71, p = 0.0002; 90% CI: 0.552–1.00), revealing that upper-limb strength remained meaningful higher than baseline, even after withdrawal, which shows considerable detention of the intervention impact.

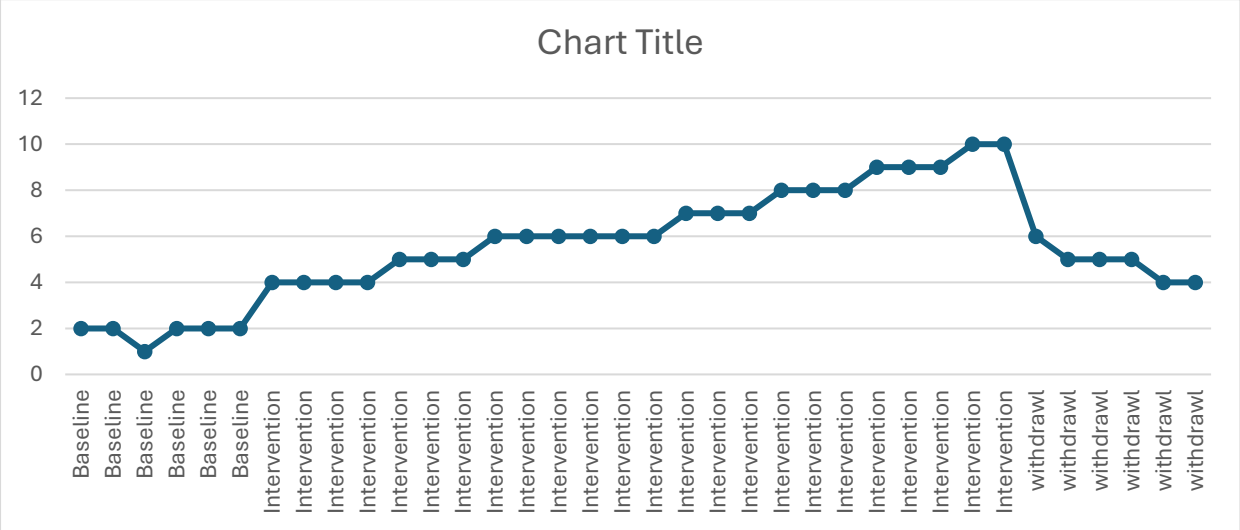

Figure 01-line graph presents student 01 performance in three stages

The graph 01 presents lower performance at baseline, enhancement during intervention, and a decrease following withdrawal.

Table: 02 "Analyzing of Student-2 scores on the Brookport Bench Press Test Across"

Phase of study	Pairs	Tau-U	Z	P	90%Cl
Baseline vs Intervention	144	1.0139	3.7849	0.0002	0.573 - 1.00
Intervention vs Withdraw	144	-2.5347	-9.4622	0.0000	-1.00 - -1. 00
Baseline vs Withdraw	36	0.8333	2.4019	0.0163	0.263 – 1.00

Table 02 shows the comparison between Baseline and Intervention phases showed a strong positive effect (Tau-U = 1.01), with a statistically significant Z value (Z = 3.78, p = 0.0002). The 90% confidence interval (0.573–1.00) point to a large and positive enhancement in upper-limb muscular strength following the execution of the physical training program. This result gives an idea that the intervention was strongly effective in increasing muscular strength over baseline levels.

On the other hand, the analyzing between the Intervention and Withdrawal phases explained a strong negative effect (Tau-U = −2.53), which was also statistically significant (Z = −9.46, p < 0.001). The confidence interval (−1.00 to −1.00) shows a complete change of gains, showing a valuable decrease in upper-limb muscular strength after the withdrawal of the intervention. These findings show the dependence of performance improvements on the carry-on application of the training program.

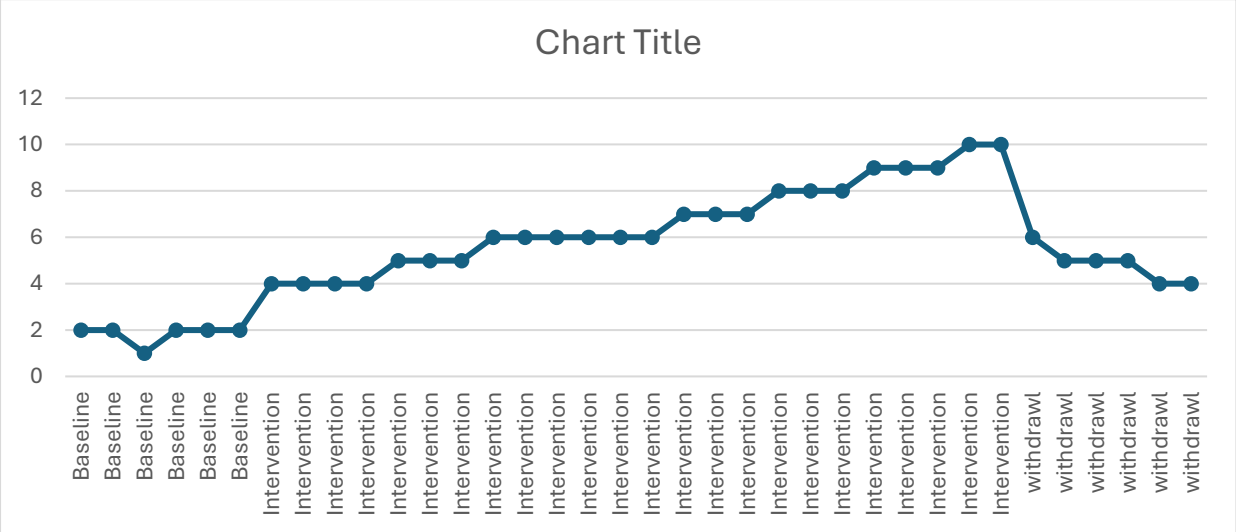

Figure 02-line graph highlights student 01 scores in three stages

The graph presents lower performance at baseline, enhancement during intervention, and a decrease following withdrawal

Table:03 "Analyzing of Student -3 scores on the Brookport Bench Press Test"

Phase of study	Pairs	Tau-U	Z	P	90%Cl
Baseline vs Intervention	144	1.0139	3.7849	0.0002	0.573 - 1.00
Intervention vs Withdraw	144	-2.5486	-9.514	0.0000	-1.00 - -1. 00
Baseline vs Withdraw	36	0.5556	1.6013	0.1093	0.015 – 1.00

Table 03 displays the **Baseline vs Intervention** analysis showed a **strong positive effect** (Tau-U = 1.01) with a **statistically significant Z value** (Z = 3.78, p = 0.0002). The 90% confidence interval (0.573–1.00) shows a **large and strong enhancement** in upper-limb muscular strength coming the application of the intervention, display its usefulness.

The **Intervention vs Withdrawal** analysis displayed a **very powerful negative effect** (Tau-U = −2.55), which was **highly statistically significant** (Z = −9.51, p < 0.001). The confidence interval (−1.00 to −1.00) returns a **total and continue decrease** in performance after the intervention was withdrawn, showing that the examined attains were dependent on the consistent application of the training program.

On the other hand, the **Baseline vs Withdrawal** analyze showed a **medium positive effect** (Tau-U = 0.56); however, this change was **not statistically significant** (Z = 1.60, p = 0.109). Despite the confidence interval (0.015–1.00) advises some betterment relative to baseline, the lack of statistical significance highlights that upper-limb muscular strength during the withdrawal phase was **not frequently higher than baseline**.

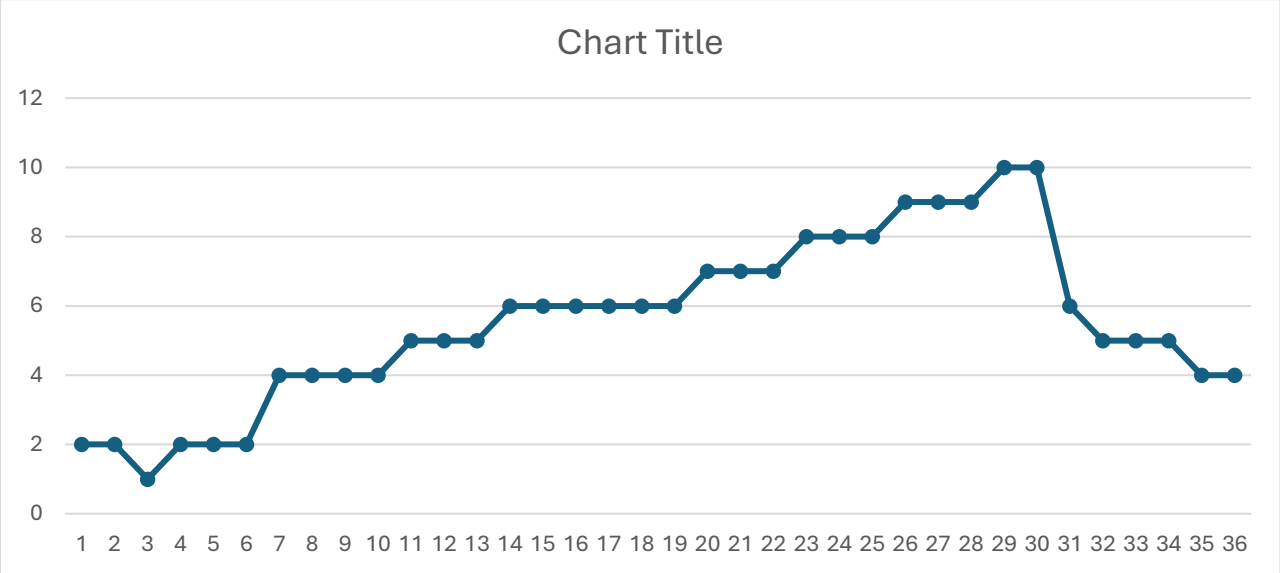

Figure 03-line graph highlights student 01 betterment in three stages

The graph presents lower performance at baseline, enhancement during intervention, and a decrease following withdrawal

Table:04 "'Analyzing of Student -4 scores on the Brookport Bench Press Test Across Study"

Phase of study	Pairs	Tau-U	Z	P	90%CI
Baseline vs Intervention	144	1.00	3.733	0.0002	0.559 - 1.00
Intervention vs Withdraw	144	-2.5486	-9.514	0.0000	-1.00 - -1. 00
Baseline vs Withdraw	36	0.3333	0.9608	0.3367	0.237 – 0.904

Table 04 displays the Baseline vs Intervention analysis highlighted a powerful positive effect (Tau-U = 1.00, Z = 3.73, p = 0.0002), with a 90% confidence interval of 0.559–1.00. This indicates a significant and consistent betterment in upper-limb muscular strength following the intervention, demonstrating its effectiveness.

The Intervention vs Withdrawal comparison revealed a very strong negative effect (Tau-U = −2.55, Z = −9.51, p < 0.001), with a confidence interval of −1.00 to −1.00. This reflects a complete and consistent decline in betterment after the intervention was withdrawn, showing that the strength gains were dependent on continued training.

Finally, the Baseline vs Withdrawal analysis showed a small to moderate positive effect (Tau-U = 0.33, Z = 0.96, p = 0.337), with a 90% confidence interval of 0.237–0.904. The lack of statistical significance highlights that upper-limb strength did not consistently stay higher than baseline after withdrawal.

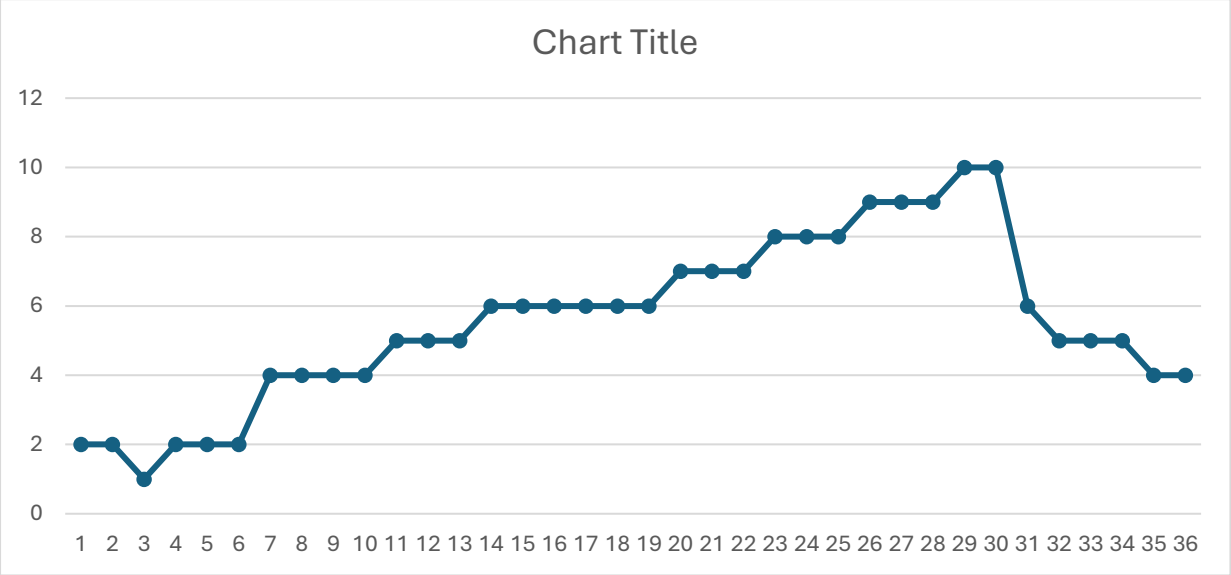

Figure 04-line graph shows student 01 betterment in three stages

The graph presents lower performance at baseline, enhancement during intervention, and a decrease following withdrawal

Table:05 "'Analyzing of Student -5 scores on the Brookport Bench Press Test Across"

Phase of study	Pairs	Tau-U	Z	P	90%Cl
Baseline vs Intervention	144	0.9931	3.7071	0.0002	0.552 - 1.00
Intervention vs Withdraw	144	-2.2569	-8.4252	0.0000	-1.00 - -1. 00
Baseline vs Withdraw	36	0.9722	2.8022	0.0051	0.401 – 1.00

The findings reported in Table 05 indicate the Baseline vs Intervention comparison showed a very strong positive effect (Tau-U = 0.993, Z = 3.71, p = 0.0002), with a 90% confidence interval of 0.552–1.00. This highlights a meaningful and reliable betterment in upper-limb muscular strength following the intervention, confirming its effectiveness.

The Intervention vs Withdrawal analysis explained a strong negative effect (Tau-U = −2.257, Z = −8.43, $p < 0.001$), with a confidence interval of −1.00 to −1.00, reflecting a substantial decrease in betterment after the intervention was withdrawn. This shows that the increases in strength were dependent on the continued application of the training program.

The Baseline vs Withdrawal analysis showed a strong positive effect (Tau-U = 0.972, Z = 2.80, p = 0.005), with a confidence interval of 0.401–1.00. This indicates that even after withdrawal, upper-limb strength remained important higher than baseline, recommending partial retention of the training effects.

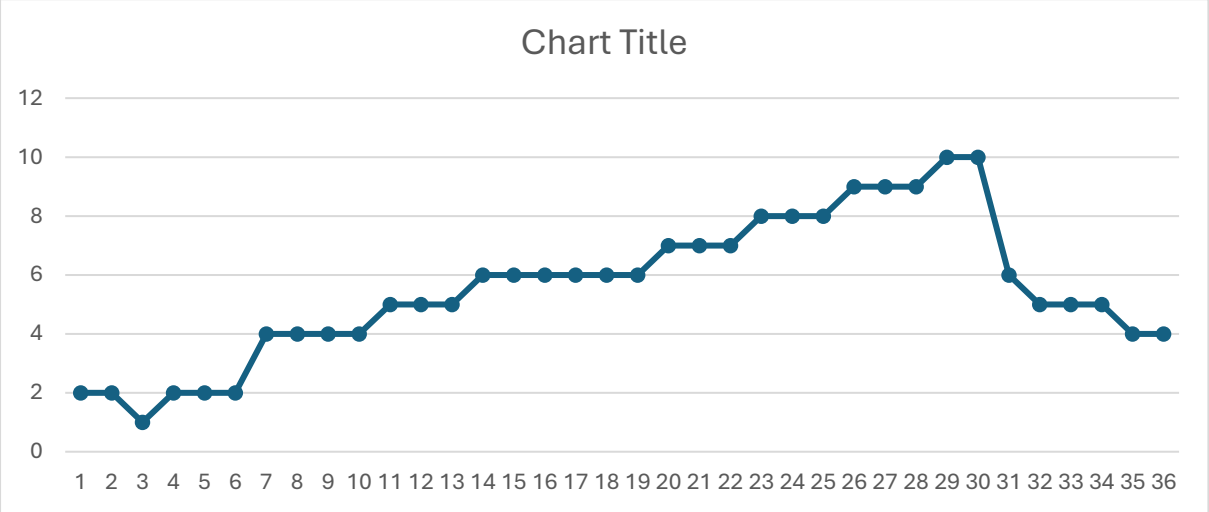

Figure 05-line graph shows student 01 scores in three stages

The graph presents lower performance at baseline, enhancement during intervention, and a decrease following withdrawal

Findings

The results show that the individualized physical training program successfully enhanced upper-body strength of all five students. The levels of strength improved significantly during the intervention period as opposed to the baseline thus showing the success of the need-based training which is individualized. Their enhancement was observed among all respondents, which indicates that the application of exercises based on their functional requirements and preliminary evaluations can result in significant advantages of muscular performance.

A temporary reduction in strength was also noted during the withdrawal period and this is normal when the regular training session is stopped. Nevertheless, the benefits of the intervention were long-lasting and sustainable because the participants maintained the majority of gains that they made throughout the program. The researchers also found that the students were more confident and more controlled in upper-limb movements, which indicated the improvement not only in strength but also in functional performance and motor control.

On the whole, the findings indicate that need-based, personalized physical training intervention is beneficial in increasing upper-body muscle strength and functional capacity among the student with disabilities. The results support the value of school-based adaptive physical education programs, which are structured and which have significant and sustainable effects on physical abilities and autonomy, even in the short-term interventions.

Conclusion

The results of this paper imply that needs-based, tailor-made physical training program proves to be very effective in enhancing upper-body strength among students with physical disabilities. The intervention generated considerable changes at the training stage, which indicates that the training under individual exercises according to the functional capabilities and muscle strengths of different students can lead to better upper-limb functioning. Notably, the gains in strength that were obtained were mostly sustained in the withdrawal phase, and it serves to illustrate the sustainability and long-term benefits of the program.

The results highlight the importance of need-based assessment instruments, i.e. Manual Muscle Testing, in the process of designing an effective training program where exercises are aimed at specific weaknesses and functional needs. The paper also highlights the importance of adaptive physical education in schools in providing support to physically impaired students where well-organized and guided programs may build on functional independence, engagement in daily activities, and general quality of life.

In general, the research offers good evidence that individualized physical exercise programs can be

a viable and efficient method of enhancing the upper-body muscle strength of students with physical disabilities and it urges the educators, therapists and policymakers to consider the implementation of such physical training programs as part of adaptive education and rehabilitation programs in schools.

Limitations

Despite the encouraging results, the research was limited in a number of ways. To start with, the sample size (five students) is too small to be generalized to a larger population of students with physical disabilities. Second, this research has been developed on one school, which might not be representative of other educational and cultural settings. Third, the withdrawal phase is very short, and thus it becomes hard to determine the long-term strength gain retention. Also, the research concentrated on upper-body strength only and had not looked into other aspects of physical fitness including endurance, flexibility and functional mobility. Lastly, individual motivation, daily activity and compliance with training protocols might have been different, which might have contributed to the results.

Implications

The results of this research have significant applications in the special education, adaptive physical education and rehabilitation programs. They propose that tailor-made; needs specific physical training interventions are useful in enhancing upper-body strength and functional autonomy among students with physical disabilities. These outcomes can be used by educators, therapists, and school administrators to create functional and individualized exercise interventions to address particular muscle weaknesses and functional needs. Besides, the paper identifies the significance of incorporating the school-based strength training in the normal school curricula as a way of improving physical fitness, increasing the participation, as well as improving the overall well-being of physically impaired students.

Future Research

Further studies are needed on how tailored physical training programs can be effective using bigger and more diverse samples, to benefit generalizations about students with physical disabilities in various population groups. Research may also investigate the long-term outcome of these interventions such as extended withdrawals to determine the maintenance of the strength gains with time. Besides, the studies can be extended beyond the strength of upper body and incorporate the other aspects of fitness, including endurance, flexibility, balance, and functional mobility. The exploration of the combination of technology-assisted or home-based instructional courses would also be a valuable source of information about scalable and available interventions. Lastly, to more clearly comprehend the holistic advantages of personalized physical training on students with physical disabilities, future researchers can take into account the psychosocial results included in the study (e.g., confidence, motivation, and involvement in everyday activities.

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