JURNAL PENELITIAN DAN PENGEMBANGAN PENDIDIKAN LUAR BIASA (JPPPLB)
Vol 13, No 1, July 2026, pp. 41-48
ISSN (print): 2355-746X; ISSN (online): 2528-3197

# The Effect of Neurocognitive Mobilisation on Attention and Response to Instruction of Students with Physical Disabilities in the Intervention Class

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*Article history:*
Received : May, 08 2026
Revised : Jul, 05 2026
Accepted : Jul, 06 2026

**Abstract**: This research examined the impact of neurocognitive mobilisation on the attention and responsiveness to classroom instruction of BS, a student with motor impairments enrolled at SLB Negeri 1 Gianyar. The study employed a quantitative methodology using a Single Subject Research (SSR) design with A–B phases, comprising an initial baseline stage followed by an intervention stage. Data collection was conducted through systematic classroom observations using an instrument designed to evaluate several behavioral indicators, including attention, concentration, motor coordination, motor control, and responses to teacher instructions across the intervention period. The validity of the observation instrument was assessed using Aiken's V, yielding a coefficient of 1.00, which indicates excellent content validity. Reliability was examined through Interobserver Agreement (IOA) to ensure consistency between observers. Comparison of the baseline and intervention phases revealed notable improvements in the participant's performance after the implementation of neurocognitive mobilisation. These improvements were reflected by an upward trend in scores, stable behavioral patterns during the intervention phase, and a relatively low percentage of overlapping data (20%) between phases. Overall, the findings suggest that neurocognitive mobilisation has the potential to enhance attention, active participation during classroom learning, and responsiveness to instructional cues among students with motor impairments in special education contexts. However, because the study involved only a single participant, the results should be interpreted with caution. Future research is recommended to include a larger number of participants and apply more robust research designs to provide stronger empirical support and improve the broader applicability of the findings.

***Keywords:*** *neurocognitive mobilisation, attention, response to instruction, single subject research, special education*

## I. Introduction

Special education is intended to provide educational services that respond to the unique learning characteristics of students with disabilities by implementing individualized, adaptive, and student-centered instructional strategies. Within this context, learners with physical and motor impairments, particularly those resulting from neurological disorders, often encounter persistent challenges in maintaining attention, controlling body movements, coordinating motor functions, and following instructional directions. Such difficulties can reduce their engagement in classroom activities and negatively affect the development of academic skills as well as adaptive behaviors. Therefore, instructional interventions should not focus solely on academic outcomes but also address the neurological processes that support learning, attention, and cognitive functioning.

Among the intervention approaches that have recently gained attention in neurorehabilitation is Neurocognitive Mobilisation (NCM). This approach combines neural mobilisation, sensory stimulation, motor exercises, and cognitive activities into an integrated and structured intervention program. Rather than concentrating exclusively on motor improvement, NCM is based on the understanding that motor and cognitive functions are closely interconnected. Accordingly, the intervention seeks to strengthen cognitive abilities such as attention, working memory, self-regulation, and problem-solving alongside motor performance. According to Tadmouri et al. (2014), repeated and systematic neurological stimulation contributes to improvements in adaptive functioning through neurocognitive rehabilitation. Supporting this perspective, Pappa et al. (2020) reported that working memory updating training enhances cognitive plasticity, attentional regulation, and self-control, all of which are fundamental components of effective learning.

DOI:%20https://dx.doi.org/10.17977/um029v13i12026p41-48

The theoretical foundation of Neurocognitive Mobilisation lies in the concept of neuroplasticity, which refers to the brain's ability to reorganize its structure and functional connections in response to experience, continuous practice, and environmental input. Research conducted by Berns et al. (2020) demonstrated that intensive cognitive stimulation promotes cortical plasticity while simultaneously improving motor abilities and attentional performance. Comparable findings were presented by Weyandt et al. (2020), who concluded that interventions grounded in neuroplasticity principles contribute positively to the development of attention, behavioral regulation, and adaptive functioning among children and adolescents. More recently, Won et al. (2023) showed that structured physical exercise strengthens neural network connectivity, which in turn supports improvements in cognitive performance and learning capacity.

In addition to neuroplasticity, the concept of cognitive reserve provides another important theoretical perspective for understanding cognitive adaptation following neurological impairment. This theory suggests that long-term engagement in meaningful learning experiences increases the brain's capacity to compensate for neurological challenges. Stern (2009) proposed that continuous cognitive stimulation strengthens cognitive reserve, allowing individuals to maintain cognitive performance even when neurological dysfunction is present. Supporting this view, Wolff et al. (2023) found that consistent participation in cognitively demanding activities reinforces cognitive reserve and contributes to learning and cognitive functioning throughout different stages of life. Attention and cognitive control are equally essential in educational settings because they enable students to sustain focus, process instructional information, and respond appropriately to classroom demands. In this regard, Parikh and Bangasser (2020) emphasized the importance of the cholinergic system in modulating attention by supporting efficient neurological processing of incoming information.

A growing body of `research has demonstrated the positive contribution of neurocognitive interventions to motor, cognitive, and adaptive outcomes. Samuelson et al. (2020) reported that repeated cognitive training programs improve attention, behavioral regulation, and adaptive functioning through continuous neurological activation. Comparable findings were presented by Doyen et al. (2020), who observed that cognitive remediation interventions increase students' attention, classroom participation, behavioral self-regulation, and social functioning, particularly among individuals with developmental disabilities. More recently, Li et al. (2023) showed that integrating physical exercise with cognitive stimulation in the form of active exergames produces measurable improvements in cognitive functioning among individuals experiencing neurological disorders. Although these findings highlight the potential benefits of neurocognitive interventions, most existing studies have focused on their implementation within clinical rehabilitation and medical therapy. Their application as an instructional strategy in special education classrooms has received considerably less attention. Furthermore, only a limited number of investigations have explored the influence of Neurocognitive Mobilisation on students' attention and responsiveness to instructional activities, particularly among learners with physical and motor impairments using a Single Subject Research (SSR) methodology. This limited body of evidence underscores the need for further investigation into the effectiveness of Neurocognitive Mobilisation as an individualized instructional intervention within special education environments.

A similar situation was observed in the intervention classroom at SLB Negeri 1 Gianyar. BS, a first-grade student diagnosed with physical and motor impairments, experienced considerable weakness in both the upper and lower limbs. These physical limitations were accompanied by difficulties in motor coordination, reduced attentional capacity, limited concentration, low spontaneous participation, and inconsistent responses to teachers' instructional directions. Because progress in the regular classroom setting remained limited, BS was transferred to an intervention classroom where individualized educational services could be provided. The intervention program consisted of fine motor exercises, gross motor activities, sensory integration, and Neurocognitive Mobilisation. Although these components were implemented simultaneously, the specific contribution of Neurocognitive Mobilisation to improvements in attention and responsiveness during learning activities had not yet been examined in a systematic manner.

To investigate this issue, the present study employed a Single Subject Research (SSR) design, which is particularly suitable for documenting behavioral changes in an individual participant

through repeated observations across successive intervention sessions. Horner et al. (2005) described SSR as an effective methodological approach for evaluating educational interventions designed for students with disabilities. In addition, Wolery et al. (2010) emphasized that interpretation of intervention outcomes can be strengthened through visual analysis of data patterns, including changes in trend, performance level, stability, and the degree of overlap between research phases. Based on these considerations, the study sought to answer the following question: How does Neurocognitive Mobilisation affect attention and responsiveness to instructional activities among students with physical and motor impairments in the intervention classroom at SLB Negeri 1 Gianyar?.

Accordingly, the primary objective of this study was to evaluate the influence of Neurocognitive Mobilisation on students' attention and responsiveness to classroom instruction within the intervention classroom at SLB Negeri 1 Gianyar by applying a Single Subject Research (SSR) methodology.

The originality of this research lies in its application of Neurocognitive Mobilisation as a pedagogical intervention within a special education classroom rather than limiting its use to clinical rehabilitation settings. Guided by the theoretical perspectives of neuroplasticity and cognitive reserve, this study employed an SSR design to investigate changes in students' attention and responsiveness to instructional cues following the intervention. Unlike previous investigations that have predominantly emphasized therapeutic or medical rehabilitation outcomes, the present study extends the implementation of Neurocognitive Mobilisation into educational practice, offering empirical evidence for its potential use as an individualized instructional approach in special education.

## II. Method

This research adopted a quantitative methodology using a Single Subject Research (SSR) design to investigate behavioral changes in an individual participant. The study followed an A–B design consisting of an initial baseline phase (A) and a subsequent intervention phase (B). As noted by Horner et al. (2005), SSR is a suitable methodological approach for systematically examining the effects of educational interventions on individual behavior, particularly within special education contexts.

The study involved a single participant, BS, who attended the intervention classroom at SLB Negeri 1 Gianyar. BS was selected through purposive sampling because the participant's educational characteristics corresponded closely with the objectives of the study. Prior to participating in the intervention program, BS consistently experienced learning difficulties, particularly in maintaining attention and responding appropriately to classroom instruction. Despite receiving regular instruction during the previous academic semester, only limited educational progress was observed. For this reason, BS was subsequently placed in the intervention classroom, where individualized educational support was provided to address these specific learning needs.

The Neurocognitive Mobilisation program consisted of a series of integrated activities, including sensory stimulation, motor coordination practice, neural mobilisation, concentration exercises, and guided responses to instructional cues. The intervention was implemented in a structured and progressive manner across repeated sessions, allowing participants to receive continuous stimulation aimed at enhancing neural connectivity while supporting the development of adaptive functioning.

Data collection was conducted using a structured observation checklist designed to measure target behaviors across seven assessment domains. These domains included sensory stimulation, neural mobilisation, attention, motor control, motor coordination, concentration, and responsiveness to instructional cues.

The study was carried out by the researcher, who simultaneously served as the teacher in the intervention classroom. Data were gathered over the course of ten intervention sessions, each of which was conducted for approximately 45 minutes.

The content validity of the research instrument was assessed through expert judgment and subsequently quantified using Aiken's V. The analysis produced a coefficient of 1.00, reflecting excellent content validity. To ensure the consistency of the observational data, instrument reliability was evaluated using the Interobserver Agreement (IOA) method. The resulting agreement coefficients reached 80% or above, indicating that the instrument demonstrated satisfactory reliability for data collection.

Behavioral observations were conducted repeatedly throughout each data collection session to monitor changes in the participant's performance over time. The resulting data were analyzed using visual analysis techniques commonly employed in Single Subject Research (SSR). This analysis included the examination of trend direction, data stability, level changes, data overlap, as well as within-condition and between-condition comparisons to evaluate the effects of the intervention.

According to Wolery et al. (2010), the analysis of overlapping data in Single Subject Research (SSR) serves as an important indicator for evaluating the effectiveness of an intervention by measuring changes in target behaviors across different experimental phases. A smaller proportion of overlapping data reflects a greater intervention effect, indicating a clearer distinction between baseline and intervention performance.

## III. Results and Discussion

### *A. Results*

#### *1) Baseline Phase (A)*

The baseline phase comprised five observation sessions conducted before the intervention was introduced. During this phase, BS's performance scores varied between 71.88% and 90.00%, with an average score of 80.43%.

Visual analysis of the baseline data demonstrated a modest upward trend together with relatively stable performance across sessions. Although gradual improvements were evident in attention, motor control, and motor coordination, these behavioral changes had not yet developed into a consistently stable pattern of performance.

#### *2) Intervention Phase (B)*

The intervention phase was conducted over five consecutive observation sessions after the implementation of the Neurocognitive Mobilisation program. Throughout this stage, BS demonstrated improved performance, with recorded scores ranging from 77.08% to 93.75%. The average performance level during the intervention reached 86.06%, indicating a higher overall level of achievement than that observed during the baseline phase.

Improvements were observed across several behavioral domains, particularly in motor coordination, attention, concentration, and responsiveness to instructional cues. In addition to these performance gains, the data collected during the intervention phase displayed a more stable pattern than those obtained during the baseline condition, suggesting greater consistency in the participant's performance following the implementation of the intervention.

*3) Visual Analysis of Single Subject Research*

The visual analysis of the data reveals a clear upward trend in the intervention phase relative to the baseline phase. Throughout the intervention period, data stability remained within acceptable parameters, supporting the reliability of the observed changes. The mean performance level increased by 5.63% from baseline to intervention, indicating a modest yet measurable improvement. Furthermore, the degree of data overlap between the two phases was limited to only 20%, suggesting a meaningful differentiation in phase distributions. Collectively, these findings provide evidence of a positive intervention effect with adequate procedural control and interpretability.

The relatively small proportion of overlapping data between the baseline and intervention phases suggests that the intervention produced a meaningful improvement in BS's target behaviors. This pattern indicates that the observed behavioral changes were associated with the implementation of the intervention and reflected positive progress across the measured domains.

Tabel 1. Baseline and Intervention Phases According to SSR Graph

| Session | Baselines (A) | Intervention (B) |
|---|---|---|
| 1 | 76.72% | 81.25% |
| 2 | 79.43% | 84.03% |
| 3 | 81.62% | 88.19% |
| 4 | 82.14% | 88.19% |
| 5 | 82.14% | 88.89% |

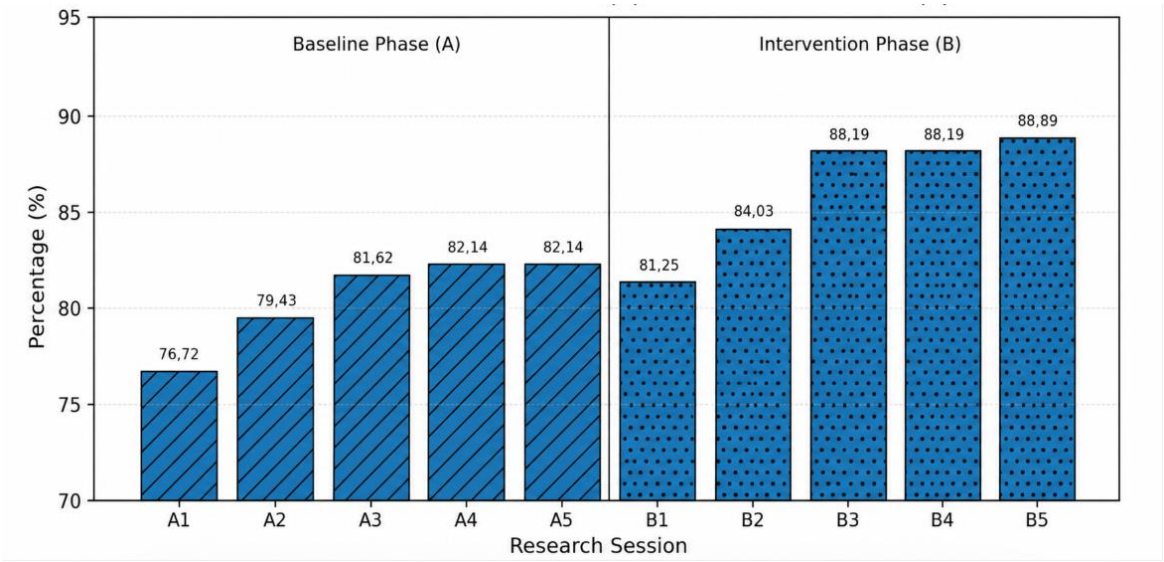


Figure 1. Mean Percentage Scores Across the Baseline (A) and Intervention (B) Phases

BS's performance during the baseline phase (A) showed a gradual upward trend from Session A1 through Session A5. The mean percentage score increased from 76.72% to 82.14%, while the observed performance pattern became increasingly stable as the baseline phase progressed.

After the Neurocognitive Mobilisation program was introduced in Phase B, BS demonstrated more substantial improvements than those observed during the baseline condition. The mean percentage score rose from 81.25% in Session B1 to 88.89% in Session B5. Visual inspection of the intervention data further indicated a steady upward trend, with performance becoming increasingly consistent across successive intervention sessions.

The observed increase in performance, combined with the relatively low proportion of overlapping data between the baseline and intervention phases, suggests that the intervention had a positive effect on several target behaviors. These improvements were reflected in enhanced attention, motor coordination, concentration, motor control, and responsiveness to instructional cues throughout the intervention period.

*4) Interpretation within Condition Analysis*

Tabel 2. Visual Analysis within Conditions

| Conditions | Baseline (A) | Intervention (B) |
|---|---|---|
| Phase Length | 5 session | 5 session |
| Estimated trend Direction | Increasing (+) | Increasing (+) |
| Stability Trend | Stable (80%) | Stable (100%) |
| Stability Level and Range | 71.88% – 90% | 77.08% – 93.75% |
| Level Change | +18.12 | +16.67 |

During the baseline phase, the data demonstrated a gradual upward trend with relatively stable performance. Following the implementation of the intervention, the upward trend became more pronounced and data stability improved further. These findings indicate that Neurocognitive Mobilisation consistently enhanced the participant's performance throughout the intervention period.

*5) Interpretation of the detween-Condition Analysis*

Tabel 3. Visual Analysis between Conditions

| Analysis Component | Result |
|---|---|
| Number of Variable Changed | 1 |
| Change in Trend Condition | (+) to (+) |
| Change in Stability | Stable to Stable |
| Level Change | (77,08 – 90) = -12,92 |
| Data Overlap | 20% |

A data overlap of 20% suggests that the majority of observations recorded during the intervention phase exceeded those obtained at baseline. In single-subject research, a lower percentage of overlap reflects a stronger intervention effect on the targeted behavior. Accordingly, the findings indicate that neurocognitive mobilization contributed to improvements in attention and responsiveness to instructional cues among students in the intervention class.

## *B. Discussion*

Based on the findings of the observation, it is evident that neurocognitive mobilization positively influenced BS's attention and responsiveness to instructional directions throughout the intervention period. These improvements were demonstrated not only by higher average performance scores but also by a more stable and consistent pattern of behavior compared with the baseline phase. Throughout the intervention period, BS showed greater attentiveness when responding to verbal prompts, particularly when their name was called, and displayed increasingly active reactions to various forms of sensory stimulation, replacing the previously passive behavioral pattern. For example, when instructed to retrieve an object, BS was able to crawl independently toward the designated item and pick it up without assistance. Repeated exposure to objects with different tactile properties also encouraged BS to intentionally grasp and squeeze nearby materials. Similarly,

performance during the ball-throwing activity evolved from unfocused and random movements to more deliberate attempts aimed at directing the ball toward a specific target, such as a basket.

The findings are in line with the theory of neuroplasticity, which suggests that repeated sensory experiences accompanied by active motor involvement promote adaptive changes within neural pathways and support the development of learning capacity (Lillard & Erisir, 2011; Weyandt et al., 2020). Through continuous neurocognitive stimulation, improvements may occur in attentional functioning, motor regulation, concentration, and students' ability to respond more effectively to instructional activities, consistent with evidence that cognitive training can induce measurable plasticity and behavioural gains (Pappa et al., 2020; Berns et al., 2020).

Within special education practice, neurocognitive mobilisation represents a promising intervention that broadens the scope of support beyond traditional academic instruction, and its holistic integration of sensory processing, motor development, and cognitive functioning aligns with the concept of cognitive reserve as a protective and facilitative mechanism in developmental contexts (Stern, 2009; Wolff et al., 2023). By integrating these domains into a unified intervention framework, this approach offers a more holistic strategy for addressing the diverse developmental needs of children with special educational needs, as also advocated in contemporary cognitive remediation models for neurodevelopmental disorders (Doyen et al., 2020).

Despite the encouraging findings, this study has several limitations; the use of a Single Subject Research (SSR) design involving only one participant limits the extent to which the results can be generalized to a broader population, a methodological constraint that has been critically discussed in special education research (Horner et al., 2005; Wolery et al., 2010). Future research is therefore recommended to employ multiple-baseline designs or larger-scale experimental studies involving a greater number of participants, as such approaches would provide more robust empirical evidence and improve the external validity and wider applicability of the findings (Li et al., 2023; Perry et al., 2020).

## IV. Conclusion and Suggestion

Based on the results of data analysis and discussion presented in the previous chapter, it is confirmed that neurocognitive mobilization produced beneficial effects on the attention and instructional responsiveness of students with special needs in the intervention class at Gianyar State Special Education School 1. These beneficial effects were demonstrated by an increase in the mean performance score from 80.43% to 86.06%, a consistently improving trend throughout the intervention phase, stable intervention data, and a low data overlap of only 20%. Overall, neurocognitive mobilization represents a viable intervention approach in special education for enhancing attention, motor coordination, motor control, concentration, and responsiveness to learning activities among students with special needs. In light of these findings, it is recommended that special education teachers integrate neurocognitive mobilization activities, including tactile object exploration, reaching and grasping exercises, and goal directed throwing tasks, into daily classroom routines to simultaneously engage sensory, motor, and cognitive processes. Furthermore, schools should provide structured training for educators to ensure consistent and appropriate implementation, while also encouraging systematic documentation of student progress to enable data driven adjustments to intervention intensity and task difficulty. Finally, future research employing larger sample sizes and controlled experimental designs is strongly encouraged to further validate these findings and expand the generalizability of neurocognitive mobilization across diverse special education contexts.

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