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The Effect of Coin Media on Addition Skills of a Student with Mild Intellectual Disability

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A B S T R A C T

Students with mild intellectual disability struggle with addition because of difficulties understanding abstract concepts, while purpose-built teaching aids may be unavailable in special schools with limited facilities. This study examined the effect of coin media on the addition skills of a third-grade student with mild intellectual disability at SKh Pelangi Anakku, Tangerang City, and whether the acquired skill persisted after withdrawal. A quantitative Single Subject Research approach employed an A_1–B–A_2 design with five sessions in each phase. The target behavior was completing five addition problems involving whole numbers from 1 to 15 without regrouping. Data were collected through tests, observation, and documentation. Instrument consistency was maintained across phases, and the student's work was reviewed with the classroom teacher. Visual analysis within and between conditions covered trend direction, stability, level change, and overlapping data. The mean score increased from 44 during the first baseline to 72 during intervention and 80 during the second baseline, representing an 81.82% increase. The 20% overlap between baseline phases indicated improved attainment. However, the level change when coins were introduced was zero, while overlap between intervention and the second baseline reached 80%; therefore, the effect of coins cannot be fully separated from the consistent worksheet format. Observations showed that the student progressed from manipulating coins to independently counting on fingers, and performance persisted after withdrawal. Coin media therefore served as a bridge toward independent counting rather than a permanently required aid. Teachers in resource-limited special schools may use available objects alongside predictable worksheets and gradual withdrawal.

INTRODUCTION

The paradigm of education for persons with disabilities has shifted from a deficit orientation toward a support orientation, namely the view that a person's learning outcomes are determined by the appropriateness of the support system provided by the environment rather than by the level of intelligence alone (American Association on Intellectual and Developmental Disabilities, 2021). The consequence of this shift is practical. A student's failure to master a given competency is no longer read as a fixed limit of ability, but as an indication that the instructional treatment provided has not been well targeted. This is particularly evident in the development of foundational numeracy skills, where students with mild intellectual disabilities frequently struggle to grasp abstract mathematical concepts (Wahyuni, 2016). To bridge this cognitive gap, educators must therefore move from symbolic representations toward concrete learning media, whose manipulability can make quantities and operations perceptible and support more accurate addition performance; evidence from single-subject research indicates that an explicit concrete-to-semiconcrete-to-abstract sequence can improve and maintain addition ability in an elementary student with intellectual disability (Park, 2024).

Within this framework, mathematics occupies a position that demands particular attention. The addition of whole numbers is a foundational competency underpinning all subsequent arithmetic operations, and at the same time a functional skill students need in order to manage money and carry out transactions independently in daily life. Mulyono (2018) positions mastery of basic arithmetic operations as a prerequisite that determines students' success in subsequent mathematics content, so that failure at this stage has a cascading effect on later levels. The difficulty is that this competency is built upon abstract symbols and relations, whereas students with mild intellectual disability rely on sensory experience, repetition, and immediate reinforcement in learning. Susanti et al. (2024) affirm that limitations in cognitive functioning and adaptive behavior require this group of students to receive adjusted services, including concrete support in the delivery of content. This mismatch between the demands of the content and the students' way of learning is the source of the difficulty, and it is not always addressed in the classroom. Meliana et al. (2024) note that instruction for students with intellectual disability in primary schools is still frequently delivered verbally and in a whole-class format without adequate adaptation of media, so that students fall behind precisely on basic arithmetic content.

The same pattern is evident in mathematics instruction in the third grade of the special primary school at SKh Pelangi Anakku, Tangerang City. The student still has difficulty solving addition problems involving whole numbers in the range of 1 to 15 without regrouping. This difficulty does not always appear as computational error, but also as irregularity in working through the worksheet, for instance completing an item in the middle first and leaving the preceding items blank. Instruction proceeds without concrete aids that the student can manipulate, so that numerical symbols are never connected to the quantities they represent.

Research on concrete media in mathematics instruction for students with special needs has developed along several lines, each leaving a different gap. In the area of product development, Nurleha et al. (2024) produced the Pakeling Bandar concept board and Pertiwi et al. (2023) developed media for introducing plane figures. Both were shown to be valid and practical, yet both rest on geometry content and stop at feasibility testing of the media rather than at measuring change in computational ability. In the area of addition, Kastiniwati and Ferdiansyah (2019) and Pujasmara et al. (2023) reported that concrete media improved learning outcomes in addition; both employed classroom action research with typically developing primary school students, so their findings cannot be transferred directly to students with intellectual disability, who require a different duration of mastery and a different pattern of reinforcement. Meanwhile, Apriliana and Afandi (2024) and Yanti et al. (2024) underscore the importance of adaptive strategies and services for students with intellectual disability, but both remain at the level of strategy and have not tested any particular medium in a measurable way. The study closest to the present context is that of Fajriani et al. (2025), who tested cubaritme media on the addition skills of students with mild intellectual disability through a single-subject design and obtained positive results. That finding shows that single-subject designs are indeed productive for testing concrete media with this population, and at the same time reveals that the media tested so far have generally been teaching aids designed specifically for instructional purposes. Yet limited facilities in many special schools mean that purpose-built aids are not always available, while everyday objects already familiar to students have rarely been tested in a measurable way on addition content.

The novelty of this study lies in the choice of medium. Coins are not teaching aids designed for instructional purposes, but everyday objects already familiar to students outside the classroom and carrying a denominational value. This characteristic distinguishes them from the purpose-built aids tested in earlier studies, since the object used for counting practice is the same object students encounter in everyday activity. That correspondence opens the possibility that addition practice does not stop at mastery of arithmetic operations within the classroom, although its connection to money management skills still requires testing through a target behavior of its own. The A_1–B–A_2 design was chosen so that the influence of the medium could be observed repeatedly in every session across the three phases, allowing the durability of the ability after the medium is withdrawn to be traced directly.

Proceeding from these gaps and considerations, this study aims to examine the effect of coin media on the ability to solve addition problems involving whole numbers in the range of 1 to 15 without regrouping in a student with mild intellectual disability in the third grade of the special primary school at SKh Pelangi Anakku, Tangerang City, and to trace the extent to which the ability formed during the intervention is maintained after the medium is no longer used. The evidence produced is expected to inform teachers in special schools when selecting mathematics learning media appropriate to the characteristics of their students, particularly in institutions with limited facilities.

METHODS

This study employed a quantitative approach using Single Subject Research (SSR) with an A_1–B–A_2 design. Unlike group designs, which infer treatment effects from comparisons of group means, SSR treats the individual as the unit of analysis and infers treatment effects from the pattern of behavioral change in a subject measured repeatedly over time (Kazdin, 2011). The A_1–B–A_2 design belongs to the reversal family, in which the treatment is withdrawn in the final phase so that the functional relation between the intervention and the target behavior can be tested while the durability of the behavior after withdrawal can be observed (Ledford & Gast, 2024). This choice aligns with the needs of special education research, which frequently contends with small numbers of subjects and highly heterogeneous individual characteristics that make between-group comparison difficult. Under such conditions, SSR is recognized as a valid approach for establishing evidence-based practice in special education (Horner et al., 2005).

The subject was one student with mild intellectual disability in the third grade of the special primary school at SKh Pelangi Anakku, Tangerang City, selected through purposive sampling, that is, the determination of a subject on the basis of particular considerations relevant to the aims of the study (Sugiyono, 2023). The considerations used were the presence of difficulty with simple addition and a need for concrete media in learning. In SSR, the use of a single subject is appropriate because the aim is to observe change in ability in detail within the individual who is the focus of the intervention. This design has been applied in a comparable context by Fajriani et al. (2025), who examined the effect of concrete media on the addition skills of students with mild intellectual disability in a special school through a single-subject design.

Data were collected through tests, observation, and documentation. The test instrument consisted of five addition items involving whole numbers in the range of 1 to 15 without regrouping, administered in every session. The items were constructed following the principles of achievement test development, namely alignment between the items and the competency to be measured and equivalence of form and difficulty across the sets being compared (Purwanto, 2020), as well as the requirements for measuring target behavior in single-subject research, which stipulate that the measuring instrument remain the same throughout all phases so that changes in performance do not stem from differences in the instrument (Sunanto et al., 2005). These principles were realised in an identical layout across all sessions, namely five numbered boxes each containing two addends and a space for the answer, and in a fixed number range and fixed number of items. The pairs of numbers were changed in each session so that the student would not simply recall previous answers. Each correct answer was scored one and each incorrect answer zero, after which raw scores were converted to a 0 to 100 scale by dividing the obtained score by the maximum score and multiplying by one hundred, following common practice in assessing learning outcomes (Purwanto, 2020). Measurement was carried out over five sessions in the first baseline phase, five sessions in the intervention phase, and five sessions in the second baseline phase. Observation was used to record how the student worked through the worksheet in each session, covering the order in which items were completed, the means by which results were obtained, and the need for step-by-step guidance. These records were used to interpret changes in performance rather than as separately scored data. Observation and checking of the student's work were carried out together with the classroom teacher who teaches the subject daily, so that judgement in each session did not depend on a single observer and misinterpretation of the student's responses could be reduced. Documentation comprising the subject's identity, the student's work, photographs of activities, and progress notes served as supporting data.

The research procedure comprised initial observation, implementation of the first baseline phase, delivery of the intervention, implementation of the second baseline phase, data analysis, and drawing of conclusions. In the first baseline phase, the student worked on the worksheet without any aid and without step-by-step guidance, so that what was recorded was the manner of working the student ordinarily employed. In the intervention phase, metal coins were provided as a counting aid. For each item, the student was asked to take coins equal to the first addend, add coins equal to the second addend, count all the coins, and then write the result in the answer space. The same sequence of steps was repeated in every intervention session. In the second baseline phase, the coins were withdrawn entirely and the student again worked on worksheets of the same format without any aid, in order to determine whether the ability formed during the intervention was maintained.

Data were analyzed through visual analysis as commonly used in single-subject research, comprising within-condition and between-condition analysis (Sunanto et al., 2005). Within-condition analysis examined condition length, trend direction determined by the split-middle method, level of stability calculated using a criterion of fifteen percent of the highest score in the phase concerned, and level change within each phase. Between-condition analysis examined the number of variables changed, change in trend direction, level change between phases, and the percentage of overlapping data. The percentage of overlap was read as an indicator of the strength of the treatment effect, in that the smaller the percentage, the stronger the inference that behavioral change originated from the intervention. As a complement, the magnitude of change was expressed as a percentage increase calculated from the difference between the mean score of the second baseline phase and that of the first baseline phase, divided by the mean score of the first baseline phase, and multiplied by one hundred percent.

RESULTS AND DISCUSSION

Measurement was carried out over fifteen sessions divided into three phases. In the first baseline phase, the scores obtained by the student were 20, 60, 40, 40, and 60, with a mean of 44. In the intervention phase, the scores were 60, 80, 60, 80, and 80, with a mean of 72. In the second baseline phase, the scores were 60, 80, 80, 100, and 80, with a mean of 80. The highest performance across the study occurred in the fourth session of the second baseline phase, when the student completed all items correctly without using coins. The distribution of scores in each session is presented in Table 1.

Students' Learning Capabilities

Table 1. Addition Scores in Each Session

Session	Baseline 1 (A_1)	Intervention (B)	Baseline 2 (A_2)
1	20	60	60
2	60	80	80
3	40	60	80
4	40	80	100
5	60	80	80

Within-condition analysis reveals a picture that warrants close attention. The trend direction in all three phases is ascending, including in the first baseline phase before the treatment was introduced. Stability calculated with the fifteen percent criterion shows that no phase met the criterion for stability, standing at 40 percent in the first baseline phase, 0 percent in the intervention phase, and 60 percent in the second baseline phase. Data in each phase fluctuated between sessions, with a range of 20 to 60 in the first baseline phase, 60 to 80 in the intervention phase, and 60 to 100 in the second baseline phase.

Between-condition analysis shows that only one variable was altered at each phase transition, namely the presence or absence of coin media. The level change from the final session of the first baseline phase to the first session of the intervention phase was zero, since both stood at 60. The level change from the final session of the intervention phase to the first session of the second baseline phase in fact declined by twenty points, from 80 to 60. The percentage of overlapping data between the intervention phase and the first baseline phase was 40 percent, between the second baseline phase and the first baseline phase 20 percent, and between the second baseline phase and the intervention phase 80 percent. The difference in means between the second baseline phase and the first baseline phase was 36 points, equivalent to an increase of 81.82 percent. A summary of all components of the visual analysis is presented in Table 2.

Table 2. Summary of Within-Condition and Between-Condition Visual Analysis

Component	Baseline 1 (A_1)	Intervention (B)	Baseline 2 (A_2)
Condition length	5 sessions	5 sessions	5 sessions
Trend direction	Ascending	Ascending	Ascending
Stability level	40% (variable)	0% (variable)	60% (variable)
Score range	20–60	60–80	60–100
Mean score	44	72	80
Level change between phases	—	0 (60 to 60)	−20 (80 to 60)
Overlapping data	—	40% with A_1	80% with B; 20% with A_1
Component	Baseline 1 (A_1)	Intervention (B)	Baseline 2 (A_2)

The student's performance rose from a mean of 44 in the first baseline phase to 72 in the intervention phase and 80 in the second baseline phase, an increase of 81.82 percent. The percentage of overlapping data between the second baseline phase and the first baseline phase, at only 20 percent, confirms that final performance differed substantially from the condition before the treatment was introduced, indicating that the treatment did affect the target behavior. Nevertheless, the pattern of data across the phases indicates that this effect did not operate solely through the presence of coins as a counting aid. Three indicators point to this reading. First, the trend direction in the first baseline phase was already ascending before the treatment was introduced, so part of the subsequent rise may represent a continuation of a pattern already underway. Second, the level change from the first baseline phase to the intervention phase was zero, meaning that no jump in performance occurred at the point when coins were introduced. Third, the percentage of overlapping data between the second baseline phase and the intervention phase reached 80 percent, indicating that performance in the two phases was scarcely distinguishable even after the medium had been withdrawn.

Observational records from each phase help explain this pattern of scores. In the first baseline phase, most of the errors that arose were unrelated to the arithmetic operation itself but concerned the manner of working through the worksheet. On several occasions the student completed the third item first and then left the first and second items blank. Attention was absorbed more in determining which part to work on than in calculating.

In the intervention phase, the student began working through the worksheet in a fixed order, from the first item to the fifth. From the second session of this phase onward, the student no longer asked which part should be completed first and instead immediately took the coins, counted, and wrote the answer. Even so, performance in this phase did not settle at a single level, and in several sessions the student was observed to lose count when the arranged coins shifted or fell.

In the second baseline phase, coins were no longer provided, yet the student continued to work through the worksheet in the same order as during the intervention phase. The student substituted the function of the coins with the fingers and completed all items without stopping midway. The observer noted that the student worked from the first item through to the fifth in sequence, without pause and without asking what steps to take.

Discussion

The most salient change across the study occurred in how the student worked through the worksheet rather than in computational ability alone. After several sessions with a fixed worksheet layout, the student completed the items in sequence without needing to ask about the steps involved. This phenomenon accords with cognitive load theory, which distinguishes the load inherent in the material from the load arising from the way it is presented (Sweller et al., 2011). Uncertainty about the order of completion belongs to the second type, a load originating not in the addition operation itself but in how the worksheet is approached. Once a fixed layout rendered the order of completion something that no longer had to be worked out, the working memory capacity previously devoted to it became available for the act of calculating. This consideration matters for students with mild intellectual disability, whose working memory capacity is limited, since reducing presentational load has a direct bearing on the space remaining for the primary task.

The finding that performance was maintained after the medium was withdrawn carries a meaning different from mere failure of the treatment. In the second baseline phase the student did not revert to the manner of working seen in the initial phase, but instead substituted the coins with the fingers. This indicates that the function of the coins had shifted from an object to be manipulated to a way of counting that could be carried out without that object.

This shift can be explained through Bruner's (1966) notion of three modes of representation: enactive, iconic, and symbolic. In the enactive mode, knowledge is stored as a sequence of actions formed through repetition, and Bruner himself associates this mode with the formation of habit. Taking, adding, and counting coins during the intervention phase placed the student in the enactive mode using an object supplied from outside. The use of the fingers in the second baseline phase shows that the same sequence of actions continued to be executed, but with a means attached to the student's own body. This shift has not yet reached the symbolic mode, since the student still required physical action to obtain a result, but it marks a reduction in dependence on an object that must be supplied by the teacher. The withdrawal of the medium in the final phase therefore did not erase the ability that had been formed; it revealed that the means supporting that ability had moved from outside the student to within.

This finding complements the results of Fajriani et al. (2025), who reported a positive effect of concrete media on the addition skills of students with mild intellectual disability through a single-subject design. The difference lies in the type of medium tested and in what remains once the treatment has ended. The medium used by Fajriani et al. was a teaching aid designed specifically for instructional purposes, whereas the present study tested an everyday object already familiar to the student outside the classroom. That difference bears directly on the gap noted earlier, namely that purpose-built aids are not always available in special schools with limited facilities, while everyday objects have rarely been tested in a measurable way on addition content. The present findings indicate that an everyday object not designed as a teaching aid can perform an equivalent function, provided its use is accompanied by a fixed sequence of actions.

The position of this study in relation to research on addition content also becomes clearer. Kastiniwati and Ferdiansyah (2019) and Pujasmara et al. (2023) reported improvements in addition outcomes through concrete media among typically developing students, yet both employed classroom action research measuring performance at the end of a cycle and therefore could not show whether the ability was maintained once the medium was no longer used. Nurleha et al. (2024) and Pertiwi et al. (2023) produced media shown to be valid and practical, but both stopped at feasibility testing of the product and did not track change in students' computational ability. The repeated measurement in the second baseline phase of the present study answers the question beyond the reach of both kinds of research, namely what remains with the student once the medium is withdrawn. The answer, as the data indicate, is a sequence of actions that has become a way of counting in its own right.

The contribution of coin media in this study is therefore best understood as an effect operating through the formation of habit rather than as an aid that must remain continuously available. The coins gave the student a clear and repeatable sequence of actions: taking, adding, counting, and then writing the result. It was this sequence that persisted and continued to be executed in the second baseline phase even though the object that had accompanied it was no longer present. Concrete media in this study thus functioned as a means of forming a counting routine, while the regularity of worksheet presentation served as the condition enabling that routine to take shape. For students with mild intellectual disability, the combination of a manipulable object and a predictable working procedure appears more decisive than either element on its own.

One matter not fully answered by the data is the functional dimension of coins that informed their selection. This study measured the ability to solve addition problems rather than the ability to recognize denominational value or carry out transactions, so the advantage of coins as objects bearing monetary value was not tested directly. Observational records show that the student treated the coins as counting units without attending to their denomination, which is unsurprising given that the task set did not require it. The link between counting practice with coins and money management skills therefore remains a possibility requiring examination through a different target behavior.

For teachers in special schools, these findings suggest that the use of concrete media be paired with regularity in worksheet format and a fixed order of completion, since the two appear to reinforce one another. Coins may serve as an affordable option in institutions with limited facilities, with the caveat that the withdrawal of the medium should be planned gradually from the outset so that students are encouraged to move toward independent counting strategies. Such withdrawal should not be abrupt, since the data in this study show a decline of twenty points in the first session after the coins were removed, before the student rediscovered a way of counting independently.

The academic contribution of this study can accordingly be stated on two levels. Theoretically, it extends the reading of concrete media beyond its function as a visual aid: because performance was measured repeatedly after the medium had been withdrawn, the durable outcome of media use is shown to be a sequence of actions that the student has taken over, a reading that brings Bruner's enactive mode and the reduction of extraneous load described in cognitive load theory to bear on a single body of data. Empirically and methodologically, it demonstrates that an everyday object carrying no instructional design, and obtainable at no cost, can occupy the position hitherto held by purpose-built teaching aids in research on addition for students with mild intellectual disability, and that a reversal design is able to distinguish a medium that forms ability from one that merely accompanies it. This distinction lies beyond the reach of the studies reviewed earlier, which measured performance only while the medium was still in use.

Several limitations should be stated so that these findings are read in proportion. First, performance in the first baseline phase had not reached stability and its trend direction was already ascending when the treatment began, so the effect of the treatment cannot be fully separated from a tendency already underway. Second, the equivalence of difficulty across sessions rests on the construction principles applied and on the consistency of layout, number range, and item count, without accompanying empirical validity testing. Third, the repetition of the worksheet format across fifteen sessions allows for a familiarity effect that cannot be separated from the effect of the medium, since this study included no comparison condition without format repetition. Fourth, the findings derive from a single subject in a single school and are not intended for generalisation. Further research is advised to extend the baseline phase until stability is reached, to test the equivalence of item difficulty empirically, and to vary the worksheet format in order to separate the effect of the medium from the effect of procedural familiarity.

CONCLUSION

Coin media affected the addition skills of a student with mild intellectual disability in the third grade of the special primary school at SKh Pelangi Anakku, Tangerang City, and the ability formed remained in place once the medium was no longer provided. Answering both aims of the study, that effect operated through the formation of a counting routine rather than through dependence on the object: what the coins supplied was a clear and repeatable sequence of actions, and the student continued to execute that sequence after the coins were withdrawn by substituting their function with the fingers. Coin media is therefore best understood as a bridge toward an independent counting strategy rather than as an aid that must remain continuously available, on the condition that its use is accompanied by a predictable working procedure, since the regularity of worksheet presentation formed part of what enabled the routine to take shape.

These conclusions should be read within the limits of the design. The study rests on a single subject in a single school and is not intended for generalisation; baseline performance had not reached stability and was already trending upward when the treatment began; and the repetition of a single worksheet format throughout the study means that the effect of the medium cannot be fully separated from that of procedural familiarity. Teachers in special schools are accordingly advised to pair concrete media with a fixed worksheet format and a fixed order of completion, to plan the withdrawal of the medium gradually rather than abruptly, and to treat readily obtainable everyday objects as a workable option where facilities are limited. Further research is recommended to extend the baseline phase until stability is reached, to test the equivalence of item difficulty empirically, to vary the worksheet format so that the effect of the medium can be separated from that of procedural familiarity, and to examine whether the monetary value carried by coins extends to money management skills through a target behavior of its own.

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