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Authentic Canteen Transactions To Improve Money-Value Equivalence In A Phase C Student With Intellectual Disability

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A B S T R A C T

Phase C students with intellectual disability often struggle to understand money-value equivalence, a functional skill essential to independence in everyday transactions, because conventional instruction has not linked the material to real experience. This study examines the effect of contextual learning (CL) on improving the understanding of money-value equivalence in a Phase C student with an intellectual disability at SLB BC Murni, Bandung. The method used was single subject research with an A1-B-A2 design. Data were collected through a rubric-based performance test covering seven ability aspects and analysed using visual analysis within and between conditions. The results show that the subject's initial ability at baseline-1 was 52.4%, rising consistently to 61.9%, 81.0%, and 90.5% across the three intervention sessions, and reaching 100% at baseline-2 after the intervention was withdrawn, with a Percentage of Non-overlapping Data (PND) of 100%, indicating a highly effective intervention. The novelty of this study lies in separating the construct of denomination recognition from that of money-value equivalence, and in the use of an authentic transaction context rather than a classroom simulation, so that the skill is formed without an additional generalisation stage. The study concludes that contextual learning through graduated authentic shopping activities effectively improves and maintains the understanding of money-value equivalence in a Phase C student with an intellectual disability in a meaningful and applicable manner.

INTRODUCTION

Functional numeracy is one of the principal prerequisites for the independence of children with intellectual disabilities living within society, particularly in everyday economic activities that require the accurate handling of money (Kurniasari, 2017; Normawati et al., 2020). According to the American Association on Intellectual and Developmental Disabilities (AAIDD, 2021), intellectual disability is characterized by significant limitations in both intellectual functioning and adaptive behavior, encompassing conceptual, social, and practical skills. Limitations in abstract thinking and problem solving mean that mastery of functional numeracy cannot be achieved through conventional, symbolically oriented academic instruction; it instead demands a pedagogical approach that is concrete, contextual, and meaningful (Nisa et al., 2021; Somantri, 2018). For this group, independence in handling money is not merely a curricular attainment but a crucial life skill that determines the extent to which they can participate actively in community life and avoid the risk of exploitation and financial loss in everyday economic transactions (Susanti & Ramadhani, 2024). Special education intervention must therefore be positioned to bridge learners' concrete modes of thinking through the direct manipulation of objects and authentic learning experiences (Hidayah et al., 2014; Rustami & Taufan, 2022).

Within special education pedagogy, the use of concrete media and assistive technology continues to develop as a means of optimizing the cognitive processes of learners with intellectual disabilities. The application of simple assistive technology, such as money calculators or interactive visual media, has been shown to simplify information processing, provide immediate feedback, and improve both motivation and accuracy in functional mathematical computation (Bouck et al., 2020; Lestari et al., 2024). Such aids reduce cognitive load by rendering mathematical operations concrete without demanding complex mental abstraction. Nevertheless, a range of studies emphasizes that the presence of mediating instruments or learning media alone is insufficient unless integrated into an ecosystem of learning experiences relevant to the learner's social context (UNESCO, 2020). Without a direct link to real-life contexts, skills trained through such media risk remaining mechanical classroom competencies that are difficult to transfer to genuine transaction situations.

Among the various domains of functional numeracy, understanding money-value equivalence occupies a position that is both critical and the most difficult for children with intellectual disabilities to master (Farhan et al., 2024; Masruroh, 2022). Cognitively, there is a fundamental difference between recognizing monetary denominations, which operates at a low perceptual level, and understanding money-value equivalence. Equivalence demands higher-order cognitive operations such as place-value understanding, flexible number decomposition, and proportional reasoning in order to grasp that a single large-denomination note is equivalent in value to several combinations of smaller denominations. Preliminary observation at SLB BC Murni, Bandung, reinforces this phenomenon. The Phase C student with an intellectual disability recognized the physical appearance and denomination of banknotes, yet experienced considerable difficulty when required to carry out transactions involving the exchange of denominations, the calculation of change, and the equating of values. In-depth interviews with the student's parents further confirmed that an inability to estimate the value of change when shopping independently left the child heavily dependent on adult assistance and vulnerable to loss. This gap indicates that the conventional instructional model applied thus far has remained focused on abstract paper-based exercises and has failed to equip learners with flexible generalization capabilities. Comparable difficulties in interpreting mathematical word problems have also been documented among other learners with special needs, suggesting that the barrier is rooted in the presentation of material detached from experiential context (Anditiasari, 2020; Hidayah et al., 2014; Kurniasari, 2017).

A review of the existing literature shows that various instructional strategies have been tested to address numeracy barriers among children with intellectual disabilities, yet a fundamental scientific gap remains. Studies by Sismonita and Marlina (2024) and Oktaviani et al. (2023) confirm that low mastery of monetary value among these children stems from the dominance of teacher-centred conventional methods with little concrete variation. Other research groups, including Relingga et al. (2025), Farhan et al. (2024), and Maslakha et al. (2026), have attempted more varied approaches such as realistic mathematics education and the use of simulated money media. However, the interventions in these studies have generally remained at the level of recognizing basic forms and denominations, relying on classroom transaction simulations with toy money. Although classroom simulation yields initial progress, this approach creates a generalization barrier, namely the difficulty children with intellectual disabilities face in transferring skills from artificial classroom conditions to real transaction settings replete with social dynamics and environmental distraction. Meanwhile, Root et al. (2018) demonstrated that linking mathematics to real-life contexts effectively improves problem solving among secondary students with intellectual disabilities, yet that study did not isolate and examine the construct of money-value equivalence specifically.

Based on this mapping of the literature, two crucial gaps remain unresolved in previous publications. First, most prior studies treat the ability to recognise money and the ability to understand

money-value equivalence as a single homogeneous construct, even though the two impose markedly different cognitive processing demands and require distinct pedagogical remediation strategies. Second, the heavy reliance on simulated toy-money media within the classroom leaves a wide ecological gap between the learning setting and actual transactions in the field, which is particularly problematic for children with intellectual disabilities given their inherent limitations in generalizing learning outcomes.

These two scientific gaps form the basis for determining the novelty of the present study, which is anchored in the framework of contextual learning as a holistic pedagogical approach linking instructional material directly to learners' real experiences (UNESCO, 2020). The novelty of this study centres on two principal aspects. First, it offers ecological and methodological novelty by integrating graduated real shopping transactions conducted directly in the school canteen (warung sekolah) rather than classroom simulations with imitation money. This approach enables functional numeracy skills to be formed directly within the authentic environment in which they will be used, thereby eliminating the need for the additional generalization stage that has long constituted a point of weakness for children with intellectual disabilities. Second, it offers novelty of construct and analysis by drawing a clear distinction between the construct of denomination recognition and that of money-value equivalence as two independent variables. Change in, and the durability of, the understanding of money-value equivalence is examined in depth in a Phase C student with an intellectual disability using a Single Subject Research A1-B-A2 design.

Building on these gaps, this study pursues three objectives. First, to analyse the effect of contextual learning based on graduated authentic transactions in the school canteen on the understanding of money-value equivalence in a Phase C student with an intellectual disability at SLB BC Murni, Bandung. Second, to describe the pattern of change across the seven assessed aspects during the baseline, intervention, and post-intervention phases, so that the trajectory of denomination recognition can be distinguished from that of money-value equivalence. Third, to examine whether the attainment obtained is sustained after the intervention has been withdrawn. The significance of the study is threefold. Theoretically, it sharpens the mapping of contextual learning onto functional numeracy by treating equivalence as a construct distinct from recognition. Practically, it offers special education teachers a graduated intervention procedure that can be implemented with facilities already available in schools, without specialised media. In policy terms, the findings provide an empirical basis for sequencing functional numeracy content in the Phase C curriculum for learners with intellectual disabilities, particularly the placement of authentic transaction experience within that sequence.

METHODS

This study employed a quantitative approach using the single-subject experimental method, or Single Subject Research (SSR), in which measurement is directed at documenting change in a single individual in depth rather than at statistical generalization to a wider population (Sugiyono, 2022). The design adopted was A1-B-A2, comprising three consecutive stages. The first phase, Baseline-1 (A1), aimed to establish the subject's initial level of understanding under natural conditions prior to treatment. The second phase, Intervention (B), involved the delivery of contextual learning based on real shopping transactions. The third phase, Baseline-2 (A2), aimed to measure the durability of the subject's ability after the intervention had been withdrawn. The study was carried out over three weeks across five observation sessions: one session in baseline-1, three sessions in the intervention phase, and one session in baseline-2. It should be stated openly that the number of sessions in both baseline phases falls below the SSR protocol's general recommendation of at least three data points

per phase for an adequate assessment of stability and trend direction (Ledford & Gast, 2018; Sunanto et al., 2005). This limitation arose from the availability of the subject's instructional time at school and constitutes an important caveat when interpreting the strength of the functional relation reported in the following section.

The participant was a Phase C student with an intellectual disability at SLB BC Murni, Bandung, selected on the basis of an initial assessment indicating a generalization barrier in equating monetary values. To ensure the ecological validity of the contextual approach, all intervention and performance data collection in phases B and A2 were conducted not through classroom simulation but directly in the school canteen (warung sekolah) using real goods and real money. Implementing the intervention in a natural setting is recommended in order to minimize subject reactivity while testing skills under authentic conditions (Kazdin, 2011). The procedure was closely controlled to ensure that the subject was exposed to genuine transaction dynamics while remaining educationally safe. In accordance with research ethics, the specific identity of the subject and of those who assisted with field observation has been kept entirely confidential in order to preserve objectivity and protect participant privacy.

Data were collected using a performance test measured through a structured observation rubric. To ensure analytical depth, the instrument specifically disaggregated the construct of money-value equivalence into seven hierarchical ability aspects: recognizing banknotes; ordering monetary values from largest to smallest; ordering monetary values from smallest to largest; stating monetary values from pictures; writing monetary values; matching denominations to values up to Rp10,000.00; and determining the equivalence of Rp2,000.00, Rp5,000.00, and Rp10,000.00 with Rp1,000.00 denominations. The seven aspects were arranged hierarchically, moving from perceptual recognition towards value equating, which demands the most complex cognitive operations. Each aspect was scored on a scale of 1 to 3, giving an ideal maximum score of 21, and raw scores were converted into percentages using the formula of obtained score divided by maximum score multiplied by 100 per cent. To reduce subjective bias, scoring was carried out using a rubric with clearly defined descriptors for each aspect: a score of 3 for independent performance, 2 for performance with minimal assistance, and 1 for performance with substantial assistance. Scoring was conducted by a single researcher without the calculation of an inter-observer agreement coefficient; the absence of Inter-Observer Agreement (IOA) verification is therefore acknowledged as a methodological limitation of this study (Kazdin, 2011).

The collected data were analyzed using graphical visual analysis, divided into two stages: within-condition analysis and between-condition analysis (Sunanto et al., 2005). The parameters interpreted included condition length, estimated trend direction, level of stability, and level change. In addition, to gauge the absolute effectiveness of the intervention, the study employed the Percentage of Non-overlapping Data (PND). PND was calculated by dividing the number of intervention-phase (B) data points falling above the highest data point of the preceding baseline phase (A1) by the total number of intervention-phase data points, then multiplying by 100 per cent. The higher the PND obtained, the stronger the empirical evidence that improvement in the child's ability is attributable to the effectiveness of the intervention rather than to a spurious effect or chance (Scruggs & Mastropieri, 1998).

RESULTS AND DISCUSSION

1. Findings

Baseline-1 measurement showed a raw score of 11 out of a maximum of 21, equivalent to 52.4% (Table 1). The subject was able to recognise banknotes independently (score 3), while ordering monetary values from largest to smallest and vice versa still required minimal assistance (score 2). On the remaining four aspects, namely stating monetary values from pictures, writing monetary values,

matching denominations, and determining the equivalence of Rp2,000, Rp5,000, and Rp10,000 with Rp1,000 denominations, the subject still required substantial assistance (score 1). These data confirm the problem identified in the introduction: the subject already recognized the existence of money but was not yet able to perform the more complex cognitive operation of equating monetary values, consistent with the findings of Sismonita and Marlina (2024) that children with intellectual disabilities tend to lag on the more complex aspects of monetary value relative to basic recognition.

Table 1. Summary of Rubric Scores for Understanding of Money-Value Equivalence at Baseline-1 and Baseline-2

No	Aspect Assessed	Baseline-1 Score (Pre-test)	Baseline-2 Score (Post-test)
1	Recognizing banknotes	3	3
2	Ordering monetary values from largest to smallest	2	3
3	Ordering monetary values from smallest to largest	2	3
4	Stating monetary values from pictures	1	3
5	Writing monetary values	1	3
6	Matching denominations to values up to Rp10,000	1	3
7	Determining the equivalence of Rp2,000, Rp5,000, and Rp10,000 with Rp1,000 denominations	1	3
	Total Score (max. 21) and Percentage	**11 (52.4%)**	**21 (100%)**

Source: Field test and observation data (2026)

Across the three intervention sessions, the subject's ability improved consistently: 61.9% in the first session, 81.0% in the second, and 90.5% in the third (Table 2). Field notes indicate that in the first session the subject still required minimal assistance in stating the amount of change and matching the value of the change, and substantial assistance in determining money-value equivalence. In the second session, when tasked with shopping against a set price list, the subject was able to state monetary values and write down the amount of change with only minimal assistance. By the third session, the subject was able to state and record the change independently, although minimal assistance was still needed in determining money-value equivalence. This consistent upward pattern, with no decline between sessions, indicates a stable and progressive intervention effect.

Table 2. Measurement Results for Understanding of Money-Value Equivalence by Session

No	Phase	Activity	Time	Score (%)
1	Baseline-1 (A1)	Measurement of initial ability without treatment	Week 1	52.4%
2	Intervention (B1)	Shopping at the canteen with mixed denominations and stating the change	Week 2	61.9%
3	Intervention (B2)	Shopping against a set price list and writing down the change	Week 2	81.0%
4	Intervention (B3)	Shopping independently and recording the transaction and change	Week 2	90.5%

Source: Field test and observation data (2026)

Baseline-2 measurement, conducted after the intervention was withdrawn, showed a perfect score of 100% across all seven aspects assessed (Table 1). The subject was able to complete every test item independently without assistance, including the money-value equivalence aspect that had previously been the weakest at baseline-1.

Between-condition analysis showed a level change of +9.5 percentage points between baseline-1 and the first intervention session, a further +9.5 percentage points between the final intervention session and baseline-2, and a total level change from baseline-1 to baseline-2 of +47.6 percentage

points. The trend during the intervention phase was consistently upward across all three sessions, with no decline between sessions.

In addition, all intervention-phase data points lay above the baseline-1 data point, yielding a Percentage of Non-overlapping Data (PND) of 100%; the same pattern was evident at baseline-2, which likewise exceeded the subject's initial attainment. According to the PND interpretation criteria, a value above 90% indicates that the contextual learning provided was highly effective in improving the subject's understanding of money-value equivalence (Susetyo, 2021).

2. Discussion

This perfect PND figure warrants careful interpretation, since it reflects not merely the strength of the contextual approach as a method but also the removal of the generalization barrier that has hitherto been the principal obstacle in simulation-based interventions. At baseline-1, the subject was assessed on a skill that had never been trained in a genuine transaction situation, and the score consequently remained low at 52.4%. Once the intervention began, the subject was not required to learn the skill in one environment and then transfer it to another, because learning took place precisely where the skill would be used, namely the school canteen with real goods and real money. It is this compression of ecological distance that caused every intervention data point to exceed the highest baseline point without any overlap. By contrast, interventions relying on toy money in the classroom, as in the studies by Relingga et al. (2025), Farhan et al. (2024), and Maslakha et al. (2026), retain an additional stage of transferring the skill from an artificial to a real context, and it is at that stage that children with intellectual disabilities typically lose part of their attainment. Even so, a PND of 100% must be read with caution, as it derives from a single subject with a score range that permits a ceiling effect at baseline-2; the figure therefore describes the consistency of the direction of change in the subject studied rather than a generalisable estimate of effect size.

These results indicate that contextual learning not only improved the understanding of money-value equivalence during the intervention but also produced gains that were sustained at baseline-2.

This consistent pattern of improvement, culminating in a perfect score, aligns with the principle of contextual learning, which emphasizes meaningful learning through direct experience (Susanti & Ramadhani, 2024). The graduated real shopping activities, moving from full support towards independence, gave the subject the opportunity to construct understanding through repetition within an everyday context, consistent with the characteristic of children with intellectual disabilities of learning more effectively through concrete repetition than through abstract instruction (Somantri, 2018). The pattern of gains across the seven aspects further clarifies why this distinction matters: recognition-level aspects were already secure at baseline and improved little, whereas the equivalence aspect moved from the lowest score to full independence. This asymmetry indicates that the intervention acted specifically on the construct that conventional instruction had left underdeveloped, rather than raising performance uniformly across all aspects.

Theoretically, this pattern is explained by the convergence of two frameworks. From the perspective of the zone of proximal development, the graduated design—full assistance, then minimal assistance, then independence—operates as scaffolding that is systematically withdrawn as the learner's self-regulation grows, so that the gain observed reflects internalisation rather than imitation (Vygotsky, 1978). From the perspective of situated learning, money-value equivalence is not stored as an isolated symbolic proposition but is constituted through participation in the practice in which it is used: the canteen transaction supplies an immediate logical consequence—change whose accuracy must be verified—that renders a mathematical error socially perceptible to the learner (Lave & Wenger, 1991). Together the two frameworks account for the asymmetry of gains reported above. Recognition-level aspects require only perceptual discrimination and were therefore already secure at baseline, whereas equivalence requires number decomposition and proportional reasoning, which are

more readily constructed when the operation is embedded in a consequential activity rather than presented as a paper exercise.

These findings reinforce those of Relingga et al. (2025) concerning the effectiveness of contextual learning in money-value instruction, while extending them through two new contributions. First, this study demonstrates that the effect of contextual learning is not confined to the recognition of monetary value alone but extends to the higher-order skill of money-value equivalence, a skill that in the studies of Sismonita and Marlina (2024) and Oktaviani et al. (2023) remained difficult to attain through game-based or conventional expository approaches. Second, by employing a real shopping context in the school canteen rather than a toy-money simulation in the classroom, this study shows that the transfer of skills to everyday situations can be achieved directly, without requiring an additional generalization stage, because the learning process itself takes place in the real environment in which the skill will be used.

Situated within recent international literature, these findings are consistent in direction with single-case studies that have taught making change to learners with intellectual and developmental disabilities using virtual money manipulatives combined with modelling and a system of least prompts, which likewise report gains in independent accuracy that are maintained after the intervention (Bouck et al., 2024; Long et al., 2024). The present study differs from those interventions not in the graduated logic of prompting but in the locus of learning: they build the skill in a virtual or simulated medium and then require a transfer step, whereas the intervention reported here builds it in the setting of use. This is congruent with the systematic review by Anderson et al. (2024), which found community-based instruction to be effective across school, home, and community settings for learners with intellectual and developmental disabilities while noting that the evidence base remains limited. The pilot money-management programme reported by Ataviado et al. (2024) points in the same direction at a later educational stage, indicating that monetary skills strengthen when instruction is tied to the learner's actual daily routines. Read alongside the Indonesian studies discussed above, these findings suggest that the decisive variable is not the sophistication of the instructional medium but the ecological proximity between the setting of learning and the setting of use.

3. Academic contribution and implications

From a practical standpoint, these findings confirm that a graduated intervention design, moving from full support towards progressive independence within a real context, constitutes an effective strategy for special education teachers in teaching functional numeracy. Theoretically, the study reinforces the view that contextual learning for children with intellectual disabilities is more effective when material is linked to everyday life and applied in genuine learning situations. As a contribution to novelty, this study is among the SSR investigations that specifically separate the attainment of money recognition from that of money-value equivalence as two distinct constructs, while demonstrating at the individual level, rather than through group averages, that improvement in the more complex construct can be achieved through a contextual intervention based on real transactions within a relatively short period.

Beyond these contributions, the findings also carry implications for the development of functional numeracy curricula in special schools, particularly at Phase C. Material on money-value equivalence has commonly been taught only after material on money recognition is deemed complete, yet the present findings indicate that recognition and equivalence require different instructional strategies. Money recognition may be taught adequately through pictures or replicas, whereas money-value equivalence is more effectively taught through real transaction experiences that carry immediate logical consequences, such as receiving change whose accuracy must be verified. Teachers and special education curriculum developers therefore need to design instruction that progressively integrates real-life contexts, in addition to attending to the graduated sequencing of material difficulty.

Taken as a whole, the academic contribution of this study lies in three respects. It separates denomination recognition from money-value equivalence as two empirically distinguishable constructs rather than a single ability. It demonstrates, at the level of the individual rather than the group mean, that the more complex construct can be acquired and maintained through authentic transactions without an additional generalisation stage. And it extends the international evidence on community-based functional numeracy instruction to the Indonesian special school setting, where an authentic transaction environment is already available in the form of the school canteen and requires no further technological investment.

CONCLUSION

This study concludes that contextual learning based on graduated real shopping transactions has a positive effect on the understanding of money-value equivalence in a Phase C student with an intellectual disability, and is also able to sustain that attainment after the intervention has been withdrawn. The subject's ability, initially low at baseline-1 at 52.4% with the greatest difficulty in equating values across denominations, improved consistently to 61.9%, 81.0%, and 90.5% across the three intervention sessions, before reaching 100% at baseline-2. The consistency of the upward trend, with no decline between sessions, together with a Percentage of Non-overlapping Data of 100%, indicates that the change constitutes an intervention effect rather than the product of chance. The perfect attainment at baseline-2 confirms that the skill formed through authentic transactions is not transient but persists without continued support.

These findings affirm that instruction linking numeracy material to real transaction activities, rather than mere classroom simulation, enables Phase C children with intellectual disabilities to understand the concept of money-value equivalence in a more meaningful and applicable way. The novelty of this study rests on two complementary aspects. Ecologically, learning took place directly in the actual transaction environment, so that the skill was formed in the very setting in which it is used and no longer required an additional generalization stage. In terms of construct, the study treated denomination recognition and money-value equivalence as two distinct abilities and measured change in them individually through an SSR design, thereby complementing earlier research that has generally conflated the two constructs and relied on simulated media with group designs.

For special education teachers, this study recommends the graduated application of real transaction activities as a strategy for teaching functional numeracy to children with intellectual disabilities. For future researchers, it is suggested that the study be replicated with subjects of differing characteristics and levels of intellectual disability, that the duration of baseline-2 be extended to test long-term maintenance, and that other supporting variables be examined, such as the role of parental involvement in generalizing the skill at home. Consistent with the limitations noted above, such replication should involve a second observer to calculate an inter-observer agreement coefficient and should increase the number of data points in both baseline phases, so that data stability can be assessed adequately and the functional relation between the intervention and change in the target behavior can be established with greater confidence.

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