Fostering Financial Literacy in Individuals with Intellectual Disability:

A Workbook-based Co-design Study

by

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Abstract

Individuals with intellectual disabilities (ID) encounter challenges in their everyday life, particularly in managing finances due to the abstract nature of financial knowledge. Navigating financial tasks is a key part of independent living, and developing financial skills can enhance autonomy and agency for individuals with ID. This research used a qualitative approach to explore co-designing with individuals with ID on a visual-based financial literacy workbook that could support them in managing their finances. We conducted fourteen sessions with six individuals with ID across three phases: (1) individual interviews, (2) group co-design sessions, and (3) user testing sessions. The study employs a thematic analysis of transcripts, complemented by narrative and visual analyses of drawings and workbook artifacts. The findings are organized around three themes. Theme 1: Participants prioritized having multiple ways (drawing, writing, or both) to engage with the workbook rather than any specific types of illustration. Theme 2: With the facilitator's guidance, peer sharing in the group setting, and workbook diagrams and content designed from participants' feedback, the abstract financial concepts were grounded in more concrete ways. Theme 3: Simulated stories and tracking expenses helped participants to practice financial knowledge. These themes were synthesized into a learning pathway that moves from building an understanding of financial knowledge in the group setting with the facilitator, to practicing it through simulated stories, and finally to applying and reflecting on it in real-life situations. This pathway supported participants in learning and practicing financial literacy. This study presents a practical workbook that can be implemented in future financial literacy programs. This also demonstrates the value of co-designing through drawing as a research method for creating accessible learning material.

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1. Introduction

1.1 Background and Context

Individuals with intellectual disability (ID) face numerous challenges and require significant support in many aspects of their lives (Kang et al., 2025). Intellectual disability is defined as a neurodevelopmental disorder characterized by deficits in both cognitive and adaptive functioning (Patel et al., 2018; Purugganan, 2018; Boat et al., 2015). The DSM-5 identifies deficits in intellectual functioning that include "reasoning, problem-solving, planning, abstract thinking, judgment, academic learning, and learning from experience," and deficits in adaptive functioning limit an individual's ability in self-determination and fulfillment of social responsibilities (American Psychiatric Association, 2013, p 33). Enhancing self-determination becomes the focus in providing services for individuals with ID (Wehmeyer & Garner, 2003).

One crucial factor in self-determination is the development of financial literacy, which allows an individual to manage their daily living and socially engage (Root et al., 2017; Newman et al., 2011). However, in vulnerable groups, especially for individuals with ID, financial literacy is limited due to the lack of access to financial products and the need for additional support with complex tasks (Melo et al., 2023; Caniglia & Michali, 2018). Financial literacy can be defined as an individual's ability to acquire financial knowledge and make informed financial decisions and plans for their future with confidence (Huston, 2010). The core of financial literacy is personal finance, which includes "spending, budgeting, and saving money" (Amagir et al., 2018; Root et al., 2017, p. 6). Due to cognitive limitations, individuals with ID often face unique barriers in understanding abstract financial concepts, and the decision-making process could be too complex and demanding of additional support (Kang et al., 2025; Bailey et al., 2011). Therefore, it is essential to develop instructions that could reduce abstraction and cognitive load for this group when learning financial literacy.

Visual support is frequently proposed as an aid for comprehension for individuals with ID. Bailey et al. (2011) tested a visual aid in helping individuals with intellectual disabilities make decisions, and their results showed an improvement in the quality of reasoning for financial scenarios. In Melo et al. (2023)'s scoping review on financial literacy education for people with disabilities, they emphasized that much of the literature highlights the need to provide "multiple forms of engagement,

representation, action, and expression" (p. 289). They also offer examples of representation, mentioning that the use of visual pictures or graphics could be helpful when learning financial literacy (Melo et al., 2023). Both papers highlight the effectiveness of using visual representation for learning financial literacy.

Visual representation functions as an external representation that aids cognitive processing and enhances comprehension of abstract concepts (Zhang, 1997). However, the choice of representation is essential; Coppin (2014) demonstrates that pictures, diagrams, and text afford different types of understanding, with pictorial representations better suited for concrete information and symbolic representations more effective for abstract concepts. There is also debate on the effectiveness of using visual representation as an aid for individuals with ID. This issue will be discussed in more detail in the literature review section. Upon careful examination, the use of visual representation in these studies is often poorly designed and disconnected from its context, making it difficult to demonstrate its effectiveness (Saletta et al., 2019).

Another approach is to introduce drawing into the learning process, as Ainsworth et al. (2011) highlight the use of drawing in science learning, which makes thinking more concrete. Research also suggests that drawing can enhance memory, as it engages multiple forms of representation, organizes and integrates knowledge, and creates additional ways to access memory (Ainsworth et al., 2011; Fan et al., 2023). There is limited research on integrating drawing or using visual representation in the learning process for individuals with ID, but some literature has shown a positive effect when using drawing in the learning process (Duttlinger et al., 2013; Alhassan & Osei, 2022).

Simultaneously, research has shown that "individually tailored information" is the most effective approach to creating accessible resources for individuals with ID (Chinn & Homeyard, 2017). There is a need to address these gaps in providing financial literacy education for individuals with ID, which would enable them to achieve more autonomy and agency (Buhagiar & Azzopardi Lane, 2022).

Based on the definition of intellectual disability, the abstract nature of financial knowledge, and Coppin's (2014) work, pictorial representations are more concrete. Therefore, we have the hunch that the pictures could aid this group in learning financial literacy. Conversations with facilitators revealed that the existing workbook is entirely text-based and lacks visuals. In response, our study explores

how pictures can aid individuals with ID in understanding financial literacy.

For this research, we have collaborated with a Community Support Co-op (CSC). The CSC is a non-profit organization that provides services such as social enterprise and skill programs for individuals with ID. We specifically work with CSC on this financial literacy program, which has been running for over a decade, and focuses on enhancing fundamental money management skills. To run the program, CSC has designed a curriculum with a workbook (Workbook #1) that covers topics such as personal budgeting skills, ways to save money, managing expenses, understanding credit, and learning to pay bills.

In the informal discussion with the facilitators from CSC, they mentioned the need to update the workbook. Many of the examples and templates used in the workbooks are outdated, making it difficult for current participants to relate this content to their own experiences. As a result, facilitators often need to adapt the examples on the spot. The workbook is also entirely text-based and requires the integration of more visual elements, in accordance with our initial hunch on exploring the use of pictures to enhance financial literacy for this community. Correspondingly, we also aimed to integrate our design and illustration expertise to create high-quality visual aids for the workbook that are more closely aligned with participants' needs. Therefore, for this research, we focused on collaborating with CSC's financial literacy program to co-design their workbook with the participants.

1.2 Research Aim and Objectives

This study aims to address existing gaps by exploring the effectiveness of high-quality, well-designed illustrations and visual representations in enhancing financial literacy comprehension among individuals with ID. The approach involves inviting individuals with ID to create their own visual representations of financial knowledge, followed by the co-design of financial literacy materials (workbook) and tools to support the achievement of these goals and to foster independent financial management in the future. This approach is intended to improve financial comprehension, increase autonomy, and enhance the quality of life for individuals with ID. Below is the list of objectives that we want to achieve with the study.

Objective 1: Develop a comprehensive understanding of the financial literacy needs of individuals with ID. This includes gathering insights on the effectiveness of existing financial literacy programs and the materials used within them, as well as

investigating the specific challenges that individuals with ID face when managing money and striving toward financial goals.

Objective 2: Co-design financial literacy materials (workbook) and tools that enable individuals with ID to manage their finances independently and achieve their financial goals.

- Objective 2a: Co-design personalized external representations (e.g., drawings, illustrations, and other visual aids) for financial information, including guidance on navigating financial systems and understanding complex financial terms. Collaboratively develop tailored financial literacy tools to support users in reaching their personal financial goals.
- Objective 2b: Evaluate the effectiveness of teaching individuals with ID to apply design thinking and use drawing skills to create illustrations or drawings that express their financial needs and goals, fostering a deeper understanding of personal finance management.

Objective 3: In response to Objective 2, assess the usability of both approaches through a simulated financial scenario. Participants will be asked to articulate their understanding of the scenario and then apply the co-designed financial literacy tools to create a plan for achieving a specific financial goal.

1.3 Preview of the Findings

We employed a three-phase qualitative co-design method for this research to examine how the workbook-centered approach supports individuals with ID to learn basic financial literacy. The study consisted of three phases: (1) individual interviews aimed at understanding personal financial experiences, (2) teaching and co-designing the workbook with the participants in a group learning environment, and (3) evaluation of the workbook with the participants and assessing participants' understanding of financial knowledge. These three phases are discussed in more detail in Section 3.

Through the iterative research process, we developed the findings into three themes. Figure 1 represents the model that we created for this study. The initial hunch in introducing drawing as an alternative way for participants to express their ideas was helpful. However, the participants did not show any specific preference for different styles of illustration or visual representation. The workbook-centered approach, guided by the facilitator, helped the participants understand the financial concepts. More importantly, the sharing of lived experience and the peer support that happened simultaneously were the key to

learning. This also allowed us to develop diagrams and visuals that were more connected to participants' real lives. Lastly, practicing in two ways, through simulated stories and tracking their spending, helped participants to apply the knowledge and extend the learning beyond the sessions.

We present the following outline for this research: Section 1 provides an overview of the study, including background and research objectives. Section 2 will focus on delivering definitions, theories, and current practices in the literature that led to the development of the research design. Section 3 will demonstrate our research design in more detail, which includes the individual interview, group co-design sessions and user testing sessions. Sections 4 to 6 illustrated our three findings derived from the data we collected. Section 7 presents the interpretations of the findings and a discussion of three key findings, outlining a pathway to financial literacy acquisition for individuals with ID. It also addresses the study's contributions and limitations. And we conclude this study in Section 8 with implications and recommendations for future programs.

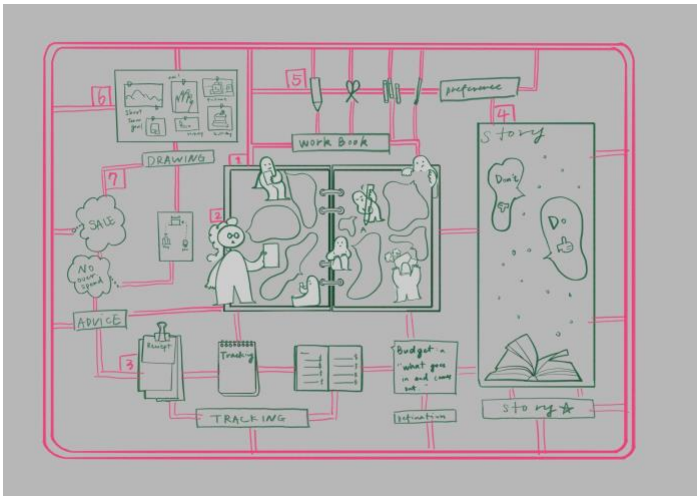

Figure 1-This figure shows the illustrated model for this study.

2. Literature review

Building on the introduction section, we recognize that individuals with ID face limited access to financial literacy education. Due to difficulties with abstract thinking, this community struggles to comprehend financial concepts. Visual representation serves as an aid to make abstract ideas more concrete. Therefore, in Section 2, we will examine three areas that guide our research design: (1) intellectual disability, (2) financial literacy education, and (3) visual representation for learning.

2.1 Intellectual Disability

Two key factors in defining intellectual disability (ID) are deficits in cognitive and adaptive functioning, which generally involve difficulties with abstract thinking, comprehension of complex ideas, and learning efficiency (Patel et al., 2018; Boat et al., 2015). By this definition, intellectual disability needs to be identified during childhood through adolescence, which will have a life-long impact "for an individual's growth and development in all functional domains"(Patel et al., 2018). Therefore, individuals with ID require different levels of support to allow them to participate in society (Boat et al., 2015).

Meanwhile, most individuals with ID are not affected by a single condition alone; instead, they often experience two or more co-occurring conditions (Cooper et al., 2015). This makes the population highly diverse, and in clinical settings, there is no single treatment that is effective for all individuals with ID (Cooper et al., 2015; Patel et al., 2020). Simultaneously, mismatches in design can create additional challenges, as the social and the physical environment are often not adapted to their specific needs (Maulik et al., 2011; Purugganan, 2018). Therefore, creating a more accessible environment for individuals with ID requires designers to familiarize themselves with and adjust to individuals' needs and provide alternative ways of interaction.

Individuals with ID face challenges in accessing healthcare, education, employment, and community engagement (Almalky, 2020; Doherty et al., 2020; Giummarra et al., 2022). Therefore, an increasing demand for "generalized cognitive skills and formal abstract

knowledge" has further restricted employment opportunities in today's information society (Dowse, 2009). These cognitive challenges, combined with limited access to information and support, often prevent individuals with ID from fully participating in decision-making and providing informed consent (Dowse, 2009).

Improving independence is the primary focus of services provided to individuals with ID. Schalock et al.'s (2017) quality of life model identifies independence as a combination of personal development and self-determination. Independence is central to improving quality of life, as it enables individuals to participate actively in society and make informed choices (Schalock et al., 2017). Self-determination, a fundamental aspect of both the quality of life model and the concepts of autonomy and agency, enables individuals to act as causal agents by "self-endorsing and self-regulating" their behaviours (Wehmeyer, 2020; Taylor et al., 2019). Research has increasingly emphasized the importance of promoting independent living for individuals with ID. However, many continue to exhibit lower levels of self-determination due to difficulties in solving adult-life problems and in transitioning toward independent living (Taylor et al., 2019; Ioanna, 2020).

Developing financial literacy is crucial for achieving independent living, as it empowers individuals to make informed financial decisions and manage their responsibilities effectively (Root et al., 2017; Newman et al., 2011; Rowe & Test, 2013). Despite the high demand in this area, opportunities to learn and practice finance-related skills remain limited in many educational and support programs for individuals with ID (Ioanna, 2020).

In Section 2.2, we will discuss the current stage of financial literacy education for individuals with ID.

2.2 Financial Literacy Education

Financial literacy is not only a practical life skill but also a foundation for intellectual growth (Kezar & Yang, 2010). There is no unified definition for the term financial literacy; most literature defines financial literacy in terms of the following categories: first, the ability to understand and communicate financial knowledge; second, the capability to make informed financial decisions, and third, the confidence in planning for the future

(Huston, 2010; Remund, 2010; Lyons, 2016). All these factors are essential to living; therefore, it is crucial to provide educational opportunities for people to develop financial literacy.

Much literature highlights the importance of financial education for different groups of individuals, including college students, adolescents, and children (Kezar & Yang, 2010; Lyons, 2016; Amagir et al., 2018). Financial literacy education has primarily been defined as comprising the following components: to gain or improve understanding of financial knowledge, to apply it in practice, to develop self-efficacy for long-term financial well-being, and to identify resources for help when facing challenges (Amagir et al., 2018; Kezar & Yang, 2010). However, the research on financial literacy education for adults with ID is limited.

Individuals with ID often struggle with complex tasks, frequently relying on single cues rather than considering multiple pieces of information (Willner et al., 2010; Danielsson et al., 2010). Financial decision-making, however, requires both understanding and reasoning with information (Willner et al., 2010; Suto et al., 2005). Suto et al. (2005) further note that although individuals with ID may face difficulties, their challenges are not particularly different from those of the general population, since financial reasoning and decision-making are complex for everyone.

Another struggle that individuals with ID face is the difficulty in mathematics that is applied in a financial context, stemming from early numeracy developmental differences, which affect an individual's ability in money handling, budgeting, and understanding value (Charitaki et al., 2025; Benavides-Varela et al., 2020). Research has also shown that difficulties in numeracy and financial reasoning are not only cognitive but also shaped by barriers embedded in instructional materials. The field of special education also highlights the need to provide programs that connect mathematics instruction with daily life practice. Therefore, this approach enables individuals to understand the importance of learning, acquiring, and applying skills in real-life situations (Kang et al., 2025). Consequently, it is essential to focus on providing support that matches the diverse needs of individuals with ID to overcome barriers, rather than assuming incapacity

based on diagnosis (Suto et al., 2005; Benavides-Varela et al., 2020).

Kang et al. (2025) conducted a systematic literature review of financial literacy education in mathematics and special education, providing valuable insights into teaching financial literacy for individuals with ID. They proposed an integrated approach that combines the focus of mathematics education on using math in financial contexts with the focus of special education on acquiring functional money skills, thereby providing better support for individuals with ID (Kang et al., 2025).

2.3 Visual Representation and Drawing

There is minimal research on testing the effectiveness of visual representation in facilitating the development of financial literacy for individuals with ID. Bailey et al. (2011) suggest that using visual aids shows a positive effect on synthesizing the information for financial scenarios. Their paper also suggests that visual aids can help people consider both the pros and cons, as well as facilitate the analysis of real-life decision-making (Bailey et al., 2011). On the other hand, Saletta et al. (2019) studied the effectiveness of using illustration for individuals with ID, and their results were negative. They investigated whether or not illustrations would improve reading comprehension in adults with intellectual and developmental disabilities. Their study concluded that illustrations did not enhance comprehension (Saletta et al., 2019). After careful examination of the illustrations used, which were simplistic line drawings resembling images filtered through Photoshop, they showed limited relevance to the text. Therefore, we believe this does not fully demonstrate the role of illustration in aiding comprehension. This suggests the need to develop high-quality illustrations and visual representations during the research process to better understand their effectiveness.

However, few studies have shown effective ways of facilitating general comprehension for individuals with ID. In Shurr and Taber-Doughty's (2017) paper, they tested the comprehension level of individuals with ID using a picture-plus-discussion intervention, which yielded a positive result. Research outside the ID field has demonstrated that combining text with corresponding pictures stimulates both hemispheres of the brain, creating a more

substantial cognitive impact and enhancing comprehension (Mosako & Ngoepe, 2020). Studies on picture books, for example, show that interactions between text and images deepen understanding (O'Neil, 2011). Effective visual representation helps readers construct a "mental model," but poor design can create cognitive overload (Glenberg & Langston, 1992; Mosako & Ngoepe, 2020). While illustrations support literacy development, they may also detract from verbal information if overused (Thiessen & Dyson, 2010). Mayer's (2001) multimedia learning theory further emphasizes that humans process visual and verbal information through separate but interconnected channels, both of which have limited capacity. Therefore, visual representation should complement rather than complicate textual information (Thiessen & Dyson, 2010; Mayer, 2001).

Another approach to accessible information for individuals with ID is the Easy Read format (AbilityNet, 2023). This approach could also be applied to developing material for financial literacy education for individuals with ID. Easy Read simplifies text through the use of controlled vocabulary, short sentences, and paired images, also highlighting the need to include visuals in creating accessible material (AbilityNet, 2023). However, its effectiveness remains debated. Hurtado et al. (2014) found that pairing pictures with text sometimes overloaded working memory, suggesting that pictures alone, accompanied by a verbal explanation, may be more effective for individuals with mild IDD. Similarly, Sutherland and Isherwood (2016) argue that although Easy Read can improve comprehension, pictures and symbols may not always enhance understanding. They recommend offering multiple formats to accommodate diverse needs.

Beyond simply using visuals in learning, introducing learner-generated drawings can support the externalization of thinking (Ainsworth et al., 2011). Learner-generated drawings refer to visual representations that students actively create during the learning process (Fiorella & Zhang, 2018). This process, often described as learning by drawing, encourages learners to select relevant text, represent it spatially in a drawing, and use prior knowledge to explain both the meaning of the text and its connection to the drawing (Fiorella & Mayer, 2016). Learning by drawing is more

effective than text-focused approaches, particularly when supported by guided instruction (Fiorella & Zhang, 2018).

This approach aligns closely with another perspective on creating accessible materials. Research has shown that information tailored to individual needs is most effective when creating accessible material (Chinn & Homeyard, 2017). Additionally, co-designing materials with participants allows them to act as "authors of accessible information and arbiters of its quality" (Chinn & Homeyard, 2017). This approach aligns with Ratto's (2021) call for design practices that engage local contexts, stakeholder needs, and professional expertise. In this research, the co-design approach ensures that materials reflect users' experiences, thereby fostering more effective and meaningful access.

Based on current literature, there is potential to discover the use of visual representation for creating accessible financial literacy material. Thus, with the gap in the current literature on financial literacy education, we aim to examine the CSC original workbook (workbook #1) to incorporate mathematics with functional instructions. However, in the design process, it is essential to design the material based on individual needs rather than those of a generalized population. Therefore, we designed the individual interview session to gain a basic understanding of each participant's lived experience. Consequently, we aim to co-design with the participants while introducing drawing during the research process to support the visualization of abstract financial concepts. In Section 3, we will provide a more detailed description of the procedure and material used across the interview, co-design and user testing sessions.

3. Methodology

3.1 Research Design

To address the research questions, this study employed a qualitative co-design approach with three phases.

Phase 1: Individual interviews

We conducted interviews with each participant to learn about their personal financial situation, how they use and manage money in daily life, and their past experiences with financial literacy education. At this stage, participants were also invited to express their thoughts through drawing. These insights provided the foundation for Phase 2.

Phase 2: Teaching and co-designing the workbook

In this phase, we introduced financial knowledge adapted from the CSC Financial Literacy program. Meanwhile, we explored how visual representation worked for the group and co-created effective visuals with the participants.

See Table 1 in Appendix A for the detailed description of each co-design session.

Phase 3: Evaluating the workbook

Lastly, we focused on evaluating the workbook and checking participants' understanding of the financial knowledge after phase 2.

From Phase 1 to Phase 3, the process was highly iterative. In particular, during the design and revision of the workbook, data collected from earlier phases informed the design of the next stage. In Section 4, we present several examples that illustrate this iterative design process.

3.2 Participants

The recruitment and screening of participants were conducted by CSC. Participants were selected based more on functional challenges rather than cognitive assessments. All six participants recruited for this research met the following detailed inclusion criteria:

1. English-speaking individuals aged 21 or above
2. Diagnosed or self-identified with Intellectual Disability
3. Have previous experience with financial activities
4. Possess any level of financial skills

3.3 Research Ethics and Accessibility

This study was approved by the Research Ethics Board of both organizations that I worked with. To ensure that participants were fully informed about the research before providing consent, all documents were provided in an accessible format, and alternative accommodations were made based on the individual participant's needs. The consent form was not only printed but also explained verbally to the participants before each interview session. To verify understanding, participants were required to correctly answer three screening questions before proceeding with research activities. Ongoing consent was checked throughout the research process.

All the sessions took place in an in-person format hosted at an organization familiar to the participants. This allowed for providing a familiar and accessible environment for the participants to engage in the research process. To ensure appropriate support throughout the research process, two CSC facilitators familiar with the participants were included, along with family members and other support persons. All participants were offered compensation for their time in participating in this research.

3.4 Materials

The material used in the co-design sessions was based on the CSC Financial Literacy program. This curriculum teaches the essential financial skills to adults with ID. All the financial concepts used in the co-design sessions were directly referenced from the CSC original workbook (workbook #1) and the feedback from the CSC facilitators. The visuals and illustrations were created based on the insights from the interview session with each participant and iteratively developed during the co-design sessions.

Drawings were also introduced to the co-design sessions, encouraging participants to draw out or write down their thoughts as they interacted with the workbook. During the co-design sessions and user testing sessions, drawing materials (pens, pencils, and markers), craft materials (glue sticks, scissors, and stickers), and printed visual representations (photos, illustrations, and icons) were also provided.

3.5 Data Analysis

All three phases adopted a similar data analysis protocol, which draws from the following data:

- Audio transcript
- Participant artifacts, which include drawings, workbook pages, and tracking sheets
- Researcher's field notes.

With all the recordings transcribed in Otter AI and manually edited, all the material was organized and coded in MAXQDA 24 and Miro.

Following reflexive thematic analysis (Braun & Clarke, 2006), we followed the six-phase approach, including (1) familiarization of the data, (2) initial

coding, (3) iterative clustering and theme development, (4) review of the themes, (5) defining the theme, and (6) editing and writing the final report. The initial coding of the data was conducted in MAXQDA, and then the process of developing themes was carried out between MAXQDA and Miro. We adopted a blend of inductive and deductive coding approaches. First, we open-coded the transcripts and the field notes to capture participants' exact words and actions. We then applied the deductive approach based on the codes when grouping them. Additionally, we evaluated the visual artifacts through systematic coding and semiotic examination (Rose, 2022). For this method, we focused on the following aspects for the participants' drawing and workbook pages: (1) denotation and connotation, (2) composition, (3) modality, and (4) anchorage. This clarified how visual choice supports understanding of the concept (Rose, 2022).

In the following Sections (4 to 6), we will provide an in-depth explanation of each stage, including our research activities, what we found, and a discussion of those findings. The overall findings will be presented in Section 7.

4. Theme 1: Choice of Representation over Visual Style

4.1 Overview of Theme 1

Recall the initial provisional hunch that visual pictorial representations could serve as an external aid for understanding abstract financial concepts by translating the abstractions to concrete metaphors. Therefore, in the research process, we proposed two ways to incorporate visual pictorial representations: (1) to ask the participants to sketch out their ideas and (2) to design visual representations or illustrations that aid comprehension for learning financial literacy.

The result showed that participants learned more effectively when they could choose how to express their ideas, rather than being given a single "best" visual representation style. No single type of visual representation worked for the entire group, as our original hunch indicated. Instead, participants emphasized the importance of having options, such as writing, drawing, or combining both, and being able to connect these methods to their lived experiences.

4.2 Evidence from the Interview Sessions

We invited the participants to draw pictures inspired by their thoughts alongside the research team during the interview sessions. During the interview, some participants preferred drawing (Figures 2.1 and 2.2), whereas others preferred writing as an input method. Participant B preferred to tell their story verbally instead of drawing it out. At the same time, participants also used a combination of both methods in responding to the interview questions.

> Participant B: "So, how about if I, if I tell you instead of drawing?"

Figure 2.1-This figure shows Participant A's drawing of their trip.

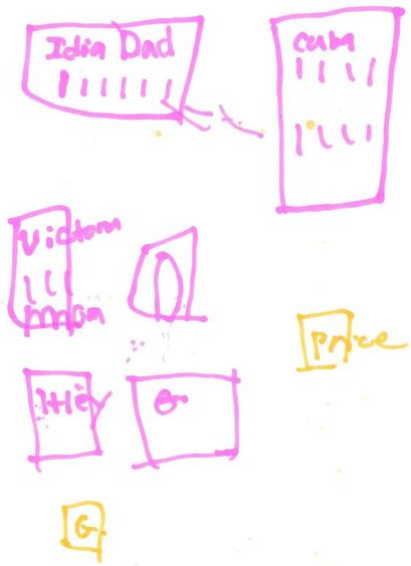

Figure 2.2-This figure shows Participant C's drawing of their past trip experience in boxes.

Participants' preference for drawing and writing varied across different phases; several participants switched between drawing and writing or used a combination of both. Some participants who used drawing in the interviews later expressed that they preferred writing as a way of expressing their thoughts during the co-design process. Additionally, Participant E did not draw much during the interview, but shared their experience as a freelance illustrator and later actively incorporated drawing during the co-design sessions. This example highlights the need to provide multiple input methods during learning so that participants can choose

based on their preference. In the next Section (4.3), I will present in detail the input methods participants used during the co-design process.

4.3 Evidence from the Co-design Sessions

During the co-design sessions, participants were encouraged to engage with the workbook according to their own needs and preferences. This approach was based on the insights that we gained through the interview sessions. Participants are encouraged to use multiple input modes, ranging from drawing to writing, and a combination of both. As shown in Figure 3, participants demonstrated different learning preferences, while some chose to record their answers in writing, others expressed their understanding through drawing.

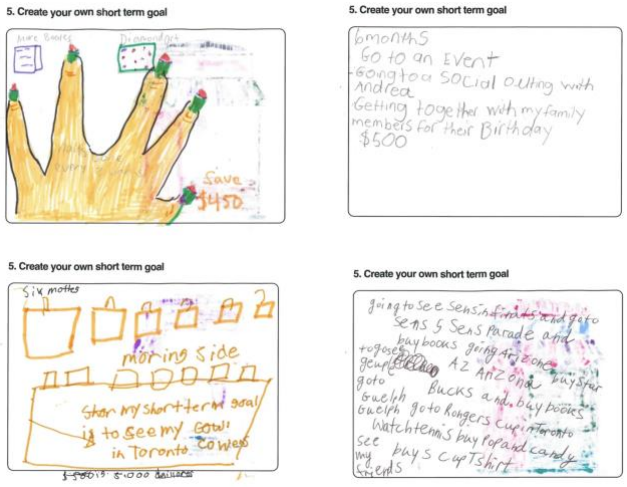

Figure 3-This figure shows the participants' responses to the short-term goal question (top left: Participant A, top right: Participant B, bottom left: Participant C, bottom right: Participant D).

During the co-design sessions, when illustrations were introduced alongside the text, participants did not show a strong preference for any specific type or style of illustration. Instead, they emphasized their interest in having illustrations included in the workbook. The use of illustrations and visuals is essential, but the specific type of illustration is shown as less important in this study. The following paragraphs provide examples from the co-design sessions to illustrate this perspective.

During Co-design Session 3, we asked participants about their preferences for using pictures or illustrations as learning tools, as shown in Figures 4.1, 4.2 and 4.3. For the same money jar concept, Figure 4.1

showed a simplified jar drawing, Figure 4.2 included a more realistic jar illustration alongside real photos of money, and Figure 4.3 showed a realistic jar drawing with bubbles for participants to fill in. Participants did not show a strong preference for any particular illustration among them. Most participants respond with "I like both".

Figure 4.1-This figure shows the money-jar illustration from the co-design session 2 workbook.

Figure 4.2-This figure shows the money coming in illustration from the co-design session 3 workbook.

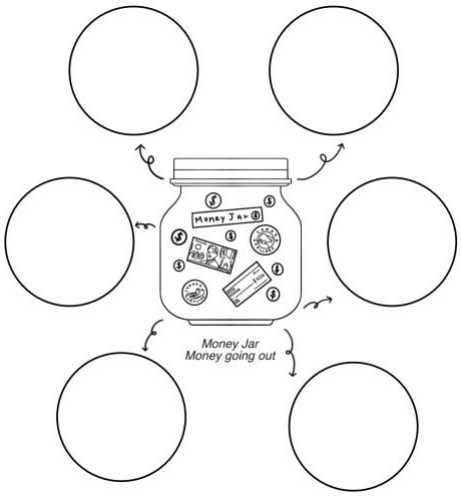

Figure 4.3-This figure shows the money going out illustration from the co-design session 3 workbook.

Across different sessions, several participants also emphasized the importance of having drawing space, highlighting their preference for having their own space to draw or write. Participant D said, "I like that for the categories." Participant A highlights the drawing aspect, "I like to getting to draw." Participant B mentioned the use of the visuals outside of the co-design session. "Maybe I can, I can teach my my mom one or I can. I could teach why my sister in law? Because she tends to like over spend money with my brother."

When asked for suggestions on the money jar illustration (Figure 4.3), participant C proposed adding "bank card" and "Presto

card". Participant C also shared experiences of using the Presto card and bank card in their daily life. Many other participants who shared similar experiences resonated with the suggestion. This response from the participants suggests that the content of illustrations should be more closely aligned with participants' lived experiences.

In the co-design sessions, we observed not only the diverse input methods participants used, but also that they valued having visual representations available and space to draw. Furthermore, Participant B demonstrated another use of the illustrations by showing them to their family and using them to teach financial literacy.

4.4 Evidence from the User Testing Sessions

The variability in participants' choices of visual representation was further confirmed in the user-testing phase. During the user testing session 2, we prepared a variety of pictures, illustrations, and iconic symbols. We also provided craft materials for the participants to make the collage. At the beginning of the session, we asked participants to choose their preferred visual representation to illustrate their financial goal and what they want to use their money for. Through Figures 5.1 to 5.9, participants' responses to the same questions (Question: What are you saving money for? What do you want to buy?) were highly diverse, showing no unified preference for using pictures or any specific illustration style.

Below are the responses that we collected during the user testing sessions. We also provided the drawings from previous sessions on the same financial goal to demonstrate the variety of input methods the participants used.

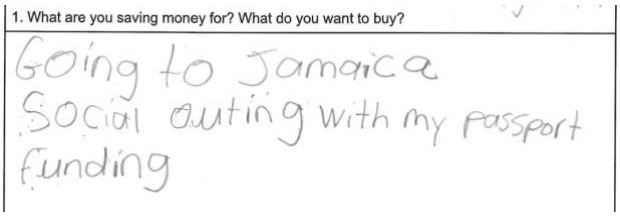

Figure 5.1-This figure shows Participant B's user testing 2 workbook Question 1 answer.

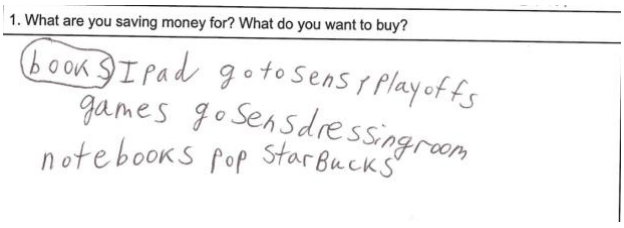

Figure 5.2-This figure shows Participant D's user testing 2 workbook Question 1 answer.

Both Participant B and Participant D respond to the question with written text that aligns with their preference in the previous session on writing over drawing.

Figure 5.3-This figure shows Participant E's user testing 2 workbook Question 1 answer.

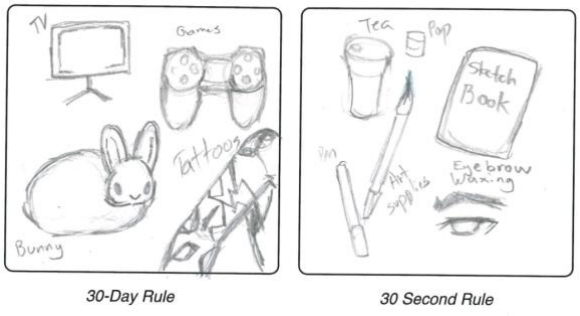

Figure 5.4-This figure shows Participant E's co-design session 4 workbook.

Participant E (Figures 5.3 and 5.4) had expressed a strong interest in drawing in earlier sessions; however, for this question, they used a combination of pictures and iconic symbols. Figure 5.4 shows Participant E's workbook page from co-design session 4, where they used drawing to represent their goal of getting a tattoo.

Figure 5.5-This figure shows Participant F's user testing 2 workbook Question 1 answer.

Participant F (Figure 5.5) was only using symbols in their answer.

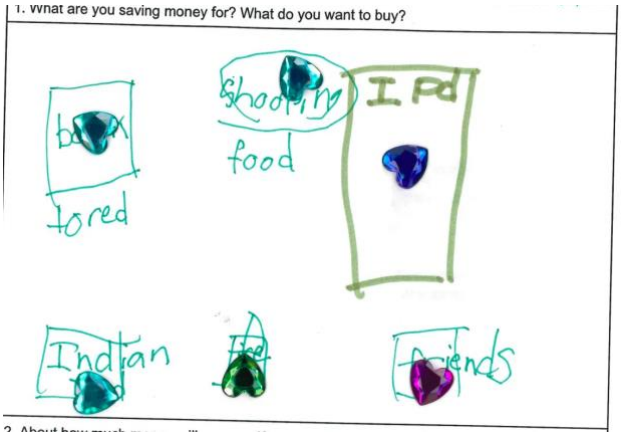

Figure 5.6-This figure shows Participant C's user testing 2 workbook Question 1 answer.

Figure 5.7-This figure shows Participant C's collage of their short-term goal.

Participant C (Figures 5.6 and 5.7) used writing and drawings of blocks to represent the saving money question, but for their goal, they chose pictures instead.

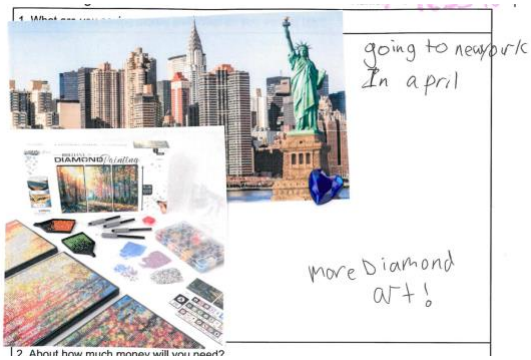

Figure 5.8-This figure shows Participant A's user testing 2 workbook Question 1 answer.

Figure 5.9-This figure shows Participant A's collage of their short-term goal.

Participant A (Figures 5.8 and 5.9) used a combination of pictures and illustrations to answer the question.

4.5 Discussion of Theme 1

Across the three phases of our research, two insights are revealed through Theme 1. First, the participants did not show a distinct preference for the visual representation style; they chose the type of representation based on their needs. Participants tended to select their preferred method of interacting with the workbook, whether through drawing, writing, or a combination of both. This did not fully align with our initial hunch that more concrete visual representations, such as photos or realistic illustrations, would be more effective. However, our study showed that visual representation is effective, especially when closely related to participants' everyday lives. At the same time, visuals that are more connected to lived experience were also perceived as more concrete. For example, participants suggested including familiar items such as Presto cards and bank cards as visuals in the workbook. This also explains why there is no unified preference for different styles of visual representation; as long as the visuals were connected to real life, they

were concrete enough for participants to understand.

Allowing participants to choose their own approach to interacting with the workbook gave them the freedom to select methods that were more concrete and better suited to their needs. If only a single mode were provided, for example, only writing or only drawing, some participants might have encountered significant difficulties with the input method. Accordingly, learning materials and environments should provide multiple options, allowing participants to choose what fits their needs rather than reducing the design to a single style-specific format.

5. Theme 2: Facilitate Learning with Workbook #2

5.1 Overview of Theme 2

In Section 5, we observed patterns in how participants acquired financial knowledge. In group learning environments, facilitators used the workbook to help participants connect abstract concepts with their lived experiences, which appeared helpful. The co-design process also shaped the workbook by incorporating participants' own definitions and drawings, aligning with Theme 1's findings on making visuals closely connected to participants' experiences. The use of diagrams as facilitation tools and aids in comprehension further demonstrates how visual representation can turn abstract concepts into concrete information. Likewise, sharing lived experiences and receiving peer support increased engagement during the learning process. Taken together, these aspects appeared to support participants in their learning about financial knowledge.

5.2 Referencing Participant's Definition of Financial Concepts

During the co-design session, participants not only shared their lived experiences but also provided their own definitions for the financial concepts. At the beginning of the first co-design session, participant B shared their understanding of the budget. "Sort of break it down, from all I can understand is, like, what's coming in and what's going out." Later, the Facilitator A also referenced the participant's definition as "Kind of refers to what you said, the in money coming in, and then what money is going out".

Figure 4.1 was developed in response to the definition provided by participant B. As illustrators, we identified the key words "coming in" and "going out" as the source of reference for developing the illustration. These terms led us to use a piggy bank as a

visual metaphor. Accordingly, we created a money jar, where the act of placing money inside represents coming in, which would be their income, and the act of taking money out represents going out as their expenses.

Figure 6.1-This figure shows Participant E's spending categories diagram.

The "money going out" bubble idea (Figure 4.3) also references participant E's drawing (Figure 6) from the interview session. Participant E drew a bubble diagram during the interview when asked about their spending while planning their trip to France. They mentioned that:

> I really enjoyed, like, seeing it in bubbles like that, because I can, I can put together, like, like food and stuff like travel, and I can just link it together, yeah.

The bubble diagram concept (Figure 4.3) was adopted as it offers participants a bounded space to reflect on their expenses, while also allowing them to add additional bubbles to represent their own individual circumstances.

Figures 6.2 and 6.3 are examples created by participants during the co-design session 3, where they used the bubble diagram to categorize their expenses.

Figure 6.2-This figure shows Participant E's money going out bubble.

Figure 6.3-This figure shows Participant A's money going out bubble.

Later in the user testing sessions 1 and 3, we also checked the participants' opinions about the money jar. Most participants expressed that they liked the money jar idea in explaining the budget concept.

5.3 Diagram as a Learning Tool

The idea of creating a diagram to explain financial concepts was based on the drawings that participants made during interviews. Figure 7.1 is a drawing created by Participant A during the interview session, where they illustrated in purple how their side business works and illustrated their expenses and challenges in accessing banking services in red. Based on Figure 7.1, diagrams can present financial knowledge more clearly and effectively.

Whether it is a diagram of a side business or a flowchart of the bank challenge, both effectively illustrate a step-by-step process that changes over time or through actions. Therefore, we have created Figure 8.1 to explain how credit works. Participants showed the effectiveness through their answers in the workbook.

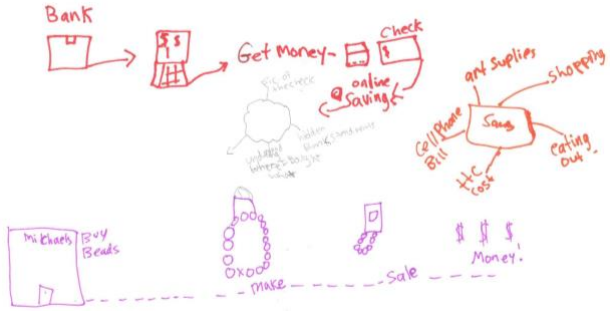

Figure 7-This figure shows the money diagram Participant A drew during the interview session.

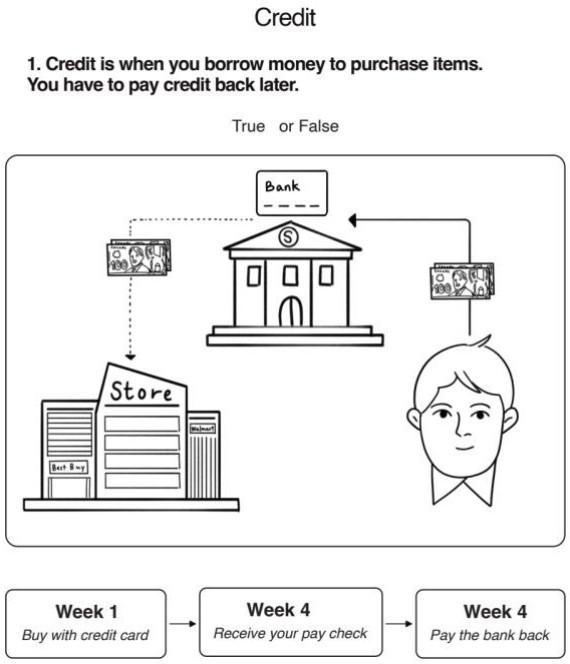

Figure 8.1-This figure shows the credit diagram from the co-design session 5 workbook.

Two participants have used or referenced the diagram in the later question to explain how credit works in the simulated financial scenario. Figure 8.2 was created by participant A, who wrote in the workbook, used the diagram, and answered verbally about the question on the concept of credit: "When you borrow money from the bank, and you have to pay back." Figure 8.3 was created by participant E, who proposed two methods for obtaining the iPad. First, they used the credit card diagram to explain, and then suggested another solution: "Save, by taking away on categories you do not need, you spend less." Both demonstrated their understanding of the concept and effectively illustrated the diagram's effectiveness in learning.

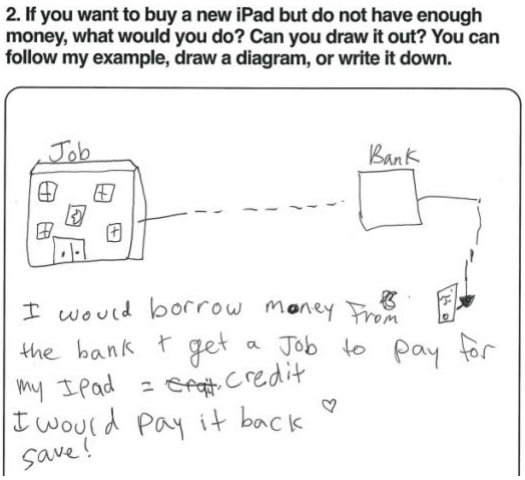

Figure 8.2-This figure shows Participant A's co-design session 5 workbook Question 2 answer.

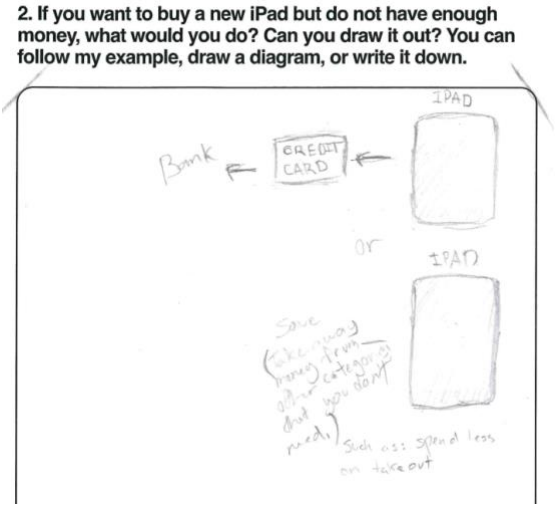

Figure 8.3-This figure shows Participant E's co-design session 5 workbook Question 2 answer.

The diagram also helps the facilitator guide participants in understanding financial concepts. The diagram proved to be not

only effective for participants to gain a much easier understanding of the financial concepts but also served as a tool for facilitation.

When participants did not fully understand a concept, the facilitator guided them by asking questions related to everyday life, helping them apply the concept in practical contexts. One example from the co-design session 5 demonstrates the effectiveness of the workbook as a facilitation tool. Participant F was confused about the concepts of credit and credit cards. The facilitator used the diagram (Figure 8.1) in the workbook and a guiding question, such as "If you want to buy something but you don't have enough money, what would you normally do?" The participant answered "borrow money," but was unsure from whom to borrow it. The facilitator followed up with the question, "Who gives you money?" The participant could easily answer that their mom would give them money. This led the participant to associate the concept of borrowing money with their mother.

To connect the experience with the concept of credit, the facilitator used the diagram again to guide participants in thinking about how credit is similar to borrowing money. Later, when asked to explain the concept in their own words while referencing the workbook, the participant described, "Borrowing money from the bank…you have to pay back." The process demonstrates that, by using the workbook material as a reference, the facilitator can guide participants in learning financial concepts.

Preliminary Discussion. This demonstrates the use of the diagram in this study; the participants could reference the diagram to understand the concepts, and the facilitator could use the diagram to guide the participants to connect the financial concepts with their daily lives to make it more concrete.

5.4 Peer Scaffolding in a Group Setting

Sharing of lived experiences among participants served as the essential component through which they acquired abstract financial concepts. During co-design sessions, participants shared their lived experiences related to financial concepts. Because these lived experiences were more concrete, they were also easier for other participants to understand.

Therefore, sharing lived experiences created opportunities for richer discussions and allowed participants to ask more detailed questions during the sessions.

In Co-Design Session 5, when discussing the benefits of having a credit card, participant E shared their experience of "building points at grocery store" by using a credit card. Participant D immediately shared, "My mom does that" and participant A shared a similar experience, "This is how I was able to pay go to Europe, because all the points we collect."

Sharing lived experiences can bridge the gap between financial concepts and daily practice, allowing participants to gain more insight into the importance of these concepts and their practical implementation. During co-design 5, the central concept discussed was the importance of not exceeding the limit on your credit card and the negative impact of not being responsible for your credit. Participant B shared a great example of this concept,

> I can tell you what happened to me about having a bad credit. I wanted was to buy a PRESTO a metro pass, and I was under over the limit, so I have to wait for a couple days for to get for them to put my disability check in into my account before I can buy the Metro pass. So I learned from that, and I don't want to over, over spend. So what I do is I see now how much I have in my account, and whatever money I have, then I have to think whether, if I can afford to afford it, or I will wait until I get my work check.

Since many of the other participants also use Presto cards, they highly resonate with this example.

The examples suggest that during the learning of financial literacy, participants would benefit from sharing more concrete, lived experiences, which would help them connect abstract concepts with real-life actions. Additionally, it would enable participants to engage more fully in the group discussion.

During the sharing of lived experiences, participants became more actively engaged in group discussions. Meanwhile, we also

observed that participants helped each other in the learning process, which was an essential factor in acquiring financial knowledge.

In co-design session 4, participant C struggled with the concept of expense. During this process, participant A uses guided questions to help participant C understand expenses.

> Participant A: So like, if you buy groceries. That's what are you spending your money on.
>
> Participant C: Yeah.
>
> Participant A: Whatever Farmboy.
>
> Participant C: Yeah.
>
> Facilitator: Expenses are what you spend your money, right? Your Money goes out.
>
> Participant A: Or if you have to pay for pedicure.
>
> Participant C: Yeah.

During the co-design process, the participants had already built a basic understanding of each other's life conditions, and they also knew each other outside of the research context. When participant A noticed that participant C did not fully understand the concept of expenses, participant A provided information related to participant C's daily life expenses to help them learn the concept.

In Co-Design Session 4, another example illustrates how other participants assisted Participant C when they were confused about the concepts. While discussing Dennis's story, the character Dennis did not check their budget before throwing a birthday party, and as a result, they didn't have enough money saved for their goal. When the facilitator pointed out that Dennis might not have saved enough money, participant C answered that Dennis could "go to the bank" and "get the money out." Then participant B asked, "What if the bank does not give you the money?" Participant D followed up by inviting Participant C to think further, and Participant D further pointed out that "Because he doesn't get enough," and "Because he overspends." This guided process did not originate from the facilitator, but rather from the participants themselves, who recognized the

misunderstanding and voluntarily offered guidance to one another.

The process of peer support during learning not only demonstrated that the participants had built a trusting and supportive learning environment with each other, but also showed their own level of understanding of the concepts by providing guidance to others. In the process of helping others, participants also strengthened their own sense of financial knowledge.

5.5 Discussion of Theme 2

Theme 2 summarizes practical approaches to using the workbook during the learning process with the participants. This can be understood in two parts: the facilitator would guide the participants in acquiring financial knowledge, and second, the participants would share their own lived experiences and help each other in the learning process. Since many of the workbook materials and visuals were co-designed with the participants, the materials became more concrete and easier for the participants to understand. The use of diagrams also made it possible to present complex financial concepts, such as money flow, more clearly and effectively. During facilitation, when facilitators referred to participants' own definitions and used diagrams, the learning process became more interactive and more closely connected to participants' everyday lives, making the concepts more concrete.

When participants share their lived experience, it can be seen as a concrete example of financial knowledge. This has also been demonstrated in the peer support case, where participants guided each other in connecting financial concepts with their lived experiences to make the financial information more concrete and comprehensible.

Both parts have demonstrated that connecting them with the lived experience of participants would be effective for learning and understanding financial concepts.

6. Theme 3: Practice of Financial Knowledge

6.1 Key Findings

Theme 3 presents the practice of learned knowledge, where participants in this research practice in two ways: first, through Dennis' story, which is designed to reflect the concepts that were learned in each session. Second, the practice is achieved through tracking daily expenses to gain more financial awareness. The story allowed participants to practice in a simulated environment, where they could

test their ideas and receive feedback from the class. Tracking daily expenses fosters awareness, and participants can also bring back the tracking sheet to receive feedback and reflections on their real-life experiences.

6.2 Practice through Story

Participants also shared their preference for learning through story. These stories were part of the original workbook (workbook #1) materials, developed in relation to the concepts introduced in each lesson. The narratives follow a boy named Dennis, who adopts various strategies and approaches to save money toward his goals. Participants read through the story at the end of each class, where they would identify what Dennis is doing right and what Dennis could improve on. Participants were able to practice what they had learned during the co-design sessions by applying it to the story setting, which provided them with additional opportunities for practice and reinforcement.

Here is a summary of Dennis's story in the co-design session 4: Dennis began tracking and applying what he had learned about saving for his own goal. He decided to stop buying daily coffee and make it at home instead. However, Dennis didn't review his monthly expenses, threw a huge birthday party, and also failed to track his receipts for the occasion.

After reading the story, we asked the participants what Dennis could have done better to achieve his long-term goal. The participants demonstrated a good understanding of the financial knowledge presented in the co-design session after reading the story. Where participant A said, "Someone in there forgot to track his money." Participant B mentioned, "he forgot to save his needs." Participant D also agreed with participant B and explained further

> Because we need to, like, write down how much you spent, yeah, and if you don't keep your recipes, then you won't know. Maybe, if he did the 30s rule ,maybe more money, or keep his receipts, yeah. He can also keep his receipt.

Preliminary Discussion. Through the discussion about Dennis's choice, the participants not only reinforced their

understanding of financial knowledge but also allowed them to practice it in a simulated real-life scenario. Where they could test different techniques in managing money, get feedback from each other and predict what would happen next.

6.3 Practice through the action of tracking

To provide participants with further practice in applying the financial concepts introduced during the co-design sessions, the original workbook (workbook #1) included an activity that asked them to track their weekly spending. In the following week's class, participants brought back their tracking sheets, which were then used as the base for discussion, allowing the participants to engage more deeply with the financial concepts they had been learning. However, the co-design sessions were spread over several months; therefore, they were not structured every week. The allocated time for the co-design sessions was 2 hours, compared to the 4-hour class. Hence, the tracking sheet was not discussed in every session, and not all participants had the opportunity to share their tracking sheets.

However, tracking is a highly effective method in practice for promoting financial literacy. Participant D demonstrated a significant improvement throughout the co-design process. During the interview stage, participant D mentioned that they do not track their expenses and that their mom will help them check their spending. Later, Participant D starts tracking immediately after we introduce the tracking sheet and asks about the price of the brownie to record it. Participant D gained a greater awareness of their spending during the co-design sessions. During co-design session 3, when discussing the need and want items in their budget sheet, Participant A thought that they did not need the Starbucks drink, but Participant D felt that it was okay to treat themselves sometimes. Furthermore, participant D also identified that the "Hokey shirt at the commercial store" was something they did not need since they "already have a lot of merch." This shows an increase in participant D's awareness of their spending, as they were able to identify through tracking what they need and what they don't need. In user testing session 1, participant D mentioned their improvement that "I going budget, like

when I go shopping, I take more recipes and I am tracking too." Participant D mentioned that they would buy a book each week since it is their hobby. In a casual conversation with participant D's family member, they also noted that participant D no longer spends as much money on buying books.

The small action of tracking their budget would allow participants to build awareness of their daily spending. By bringing this back to the learning environment, it led to the realization of the need and want in their real-life expenses. This could be a stepping stone for managing their own finances.

6.4 Discussion of Theme 3

Theme 3 demonstrates how participants practiced the financial knowledge learned during the co-design sessions in two ways. First, by practicing in simulated scenarios, participants could test their knowledge in a safe environment where mistakes would not affect their real lives. Stories, as re-creations of real life, provided this context; because they originate from lived experiences, participants were able to relate to them.

Second, when applying the knowledge in real life, participants begin with a small action, such as tracking their expenses. Tracking expenses did not directly change participants' daily lives; instead, it helped them observe their spending habits, and, in that way, they can begin to adjust their behaviour and increase their awareness of money management.

7. Discussion

7.1 Synthesis of the Three Themes

Participants' understanding of financial literacy gained through the co-design sessions evolved across three levels. At the first level, structuring the co-design sessions in a group setting enables a group discussion, supported by the facilitator's guidance on financial concepts. Participants shared examples from their lived experiences, articulated through their own understandings of relevant financial concepts. The lived experiences serve as concrete examples that encourage other participants to share similar experiences, thereby contributing to a shared understanding that develops among the participants for the same financial concept.

The act of sharing stories is an essential aspect of education, where sharing helps develop social identity and fosters connections with others, allowing other people to engage in our own experiences to support participation (Bunning et al., 2017). This aspect has also been shown through

our study, where the act of sharing lived experiences increased the engagement level of other participants. When participants listen to others' lived experiences, it functions similarly to a story, where they could use other people's experiences as a simulated environment to rehearse decision-making and state their reasons.

The sharing of lived experience and the peer support also demonstrated the learning transition from active to interactive processing. Trafton & Trickett (2001) define note-taking as active learning, where King (1992) describes the act of summarizing the knowledge into one's own definition as constructive learning. The participants taking notes on the workbook would be active learning, and when they provide their own definitions for the financial concepts, this turns into constructive learning. Chi et al. (2009) classify problem-solving with text as interactive processing, especially when learners receive peer scaffolding (Mastropieri et al., 2003).

In active learning, the process both enriches knowledge and reinforces existing understanding. Constructive learning could improve the acquisition of knowledge and make it more coherent. Thus, interactive learning allows the individual to share and be challenged by their peers to foster the exploration of new perspectives. This allows both sides to learn and to gain more perspectives. These ideas are all drawn from Chi (2009), and its perspectives also help explain the principles underlying participants' behaviours and further validate that sharing lived experiences and peer-supported learning can enhance learning outcomes.

This first level also involves the use of a workbook and a diagram in acquiring financial knowledge. The drawings created by the participants are a form of learning by drawing. This process enables participants to develop their own understanding of the financial concepts introduced. This process makes abstract concepts more concrete, while also allowing the participants to connect the abstract financial concepts to their own everyday lives.

Allowing the participants to draw is very effective across the literature. Fiorella and Mayer (2016) suggest that with specific guidance, learning by drawing could be an effective generative learning method, where it could actively allow the learner to apply their knowledge in new situations. Additionally, Coppin (2014) suggests that diagrams provide pictorial relations among symbolic items. In our research, the diagram we designed using spatial layout, arrows with concise labels, makes the

abstract financial concepts perceptually available. With the facilitator's guidance, the use of a diagram further reduces the cognitive load.

The second level is where participants practically apply their own understandings of financial concepts by utilizing the financial knowledge they gained through the story. The facilitator used stories to reinforce financial knowledge with participants, starting with simple tasks such as tracking daily expenses and gradually progressing to practical strategies that could be applied. Through these stories, participants were able to stimulate situations they might encounter in real life.

Learning through stories has been widely applied across different fields. Story could be defined as "character + predicament + attempted extrication" (Gottschall 2012, p 52). Humans are naturally inclined to remember stories, as stories are inherently concrete, especially when a story connects to personal experience, making it even more effective (McNett, 2016). McNett (2016) also notes that stories can illustrate problems or challenges, providing opportunities for discussion and enabling students to learn from these experiences. Research has shown the effectiveness of digital stories in helping children with intellectual disabilities learn mathematics. Incorporating digital storytelling enhances their understanding of math concepts and improves problem-solving skills (Kumaş, 2024). Our research also aligns with the literature, showing that when participants practiced their knowledge through stories, the approach appeared to be effective.

At the third level, through group discussions and learning through stories, participants began with small, actionable tasks, such as tracking their expenses, which enabled them to develop a more practical understanding of the financial knowledge they had acquired. Through the process of tracking their expenses and bringing the tracking sheet back to class for discussion, participants were able to learn from one another again by sharing their personal experiences of managing money. This three-level process supported participants in first building basic financial literacy, reinforcing learning through stories, applying it through the practice of tracking their expenses, and ultimately developing an understanding of how money management works in their everyday life.

Across these three levels, we can see a clear pathway when learning, allowing for flexible input methods, with facilitators' guidance to link the abstract financial concepts to concrete lived experience. Participants also contribute to the process

by sharing their lived experiences and peer support, which helps the entire group form a shared understanding of the financial concepts. This is the first step in acquiring financial knowledge. Through the simulated practice in a story, and moving into tracking and practicing financial knowledge in daily life. Together, these provide us with a method for creating accessible financial literacy learning for individuals with ID.

7.2 Contribution

In this study, participants not only learned key financial literacy concepts but also co-designed a financial literacy workbook that can be implemented for future programs. During the co-design process, participants shared suggestions for visual representations and definitions that closely aligned with their lived experiences, which turned abstract concepts into concrete drawings and plain language that was comprehensible to the participants.

This study also offers a methodological contribution by integrating drawing and design as research methods in studies with adults with ID. Through co-creating visuals and illustrations with participants, the approach facilitated multimodal input and enabled in-depth, user-centred research tailored to participants' needs. The involvement of a professional illustrator and designer ensured the production of high-quality visual materials and supported a critical evaluation of their effectiveness within the research process.

7.3 Limitations

There are several limitations in this research. The sample size of this study is small, with only 6 participants involved. Consequently, the findings of this research do not provide a generalized conclusion for the entire group of people with intellectual disabilities. Not every participant participated in every session due to personal reasons. Therefore, there is an inconsistency in the knowledge of some participants.

Some participants also had previous exposure to the original CSC financial literacy program; however, the effectiveness of the co-design sessions' teaching aspect was not demonstrated for all participants. Also, since each session was not structured week by week, the effectiveness of the co-design sessions might be affected.

More importantly, each participant has their own unique experience and struggles; therefore, more guidance is needed to ensure each participant can fully understand the financial knowledge. However, the sessions run only 2 hours, which is not enough time to provide all the support needed for the participants.

The workbook #2 has only been tested in a group format, and its effectiveness for individual use has not been evaluated. Therefore, this study doesn't aim to address the use of the workbook at a personal level.

8. Conclusion

Through working with six participants with lived experience over fourteen sessions. We found that no single illustration or visual representation style is more effective for this group. Participants engaged with multiple input modes, such as drawing, writing, or a combination of both. Participants demonstrated more effective learning outcomes when the facilitator used the workbook in a group learning setting. In this process, participants not only shared their lived experiences but were also guided through questions that drew on their experiences or their own definitions of the financial concepts. With the facilitator's guidance, they also use diagrams to interpret abstract concepts and deepen their understanding of their own experiences through self-created drawings. Ultimately, participants applied the financial knowledge they acquired in two ways: first, by using stories to simulate real-life decision-making scenarios, and second, by tracking their spending, which gradually helped them develop financial awareness. These findings demonstrate a pathway for learning financial literacy with this group, guided learning from the facilitator with the workbook, with participants contributing their own understanding of the concepts. Then participants could test and apply their knowledge through simulated stories. Lastly, participants could use the knowledge in their real lives. This pathway would enable participants to acquire financial literacy knowledge and apply it in real life, ultimately becoming more independent.

However, the findings for this research only apply to a small group; the prior program exposure also influences the results. Further work could test the model with a larger cohort and control for the effect of the previous program exposure. Additionally, further work could be conducted to examine the implementation across different programs and facilitators. Working with these limitations, this study contributes to producing a practical workbook for the future program.

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Appendix A

Table 1: Co-design sessions Procedure

Co-Design Session ID	Financial Topic	Key Activities
Co-Design Session 1	General overview of personal finance. Overview of the financial concepts, including categories of spending, need and want, budget, and financial goal	Verbal group discussion, sharing of lived experience
Co-Design Session 2	Techniques in setting a goal, short-term/long-term goal, techniques in saving money, and the budget sheet	Verbal group discussion, sharing of lived experience, drawing of financial goal, writing and drawing answers for the workbook
Co-Design Session 3	Review the budget sheet, introducing the concept of budget, tracking daily spending, and techniques for saving money	Verbal group discussion, sharing of lived experience, writing and drawing answers for the workbook
Co-Design Session 4	Introduce the concept of expenses and show examples of how to understand bills	Verbal group discussion, sharing of lived experience, writing and drawing answers for the workbook, reading Dennis' stories, and discussion about the bill example
Co-Design Session 5	Introducing the concept of credit and credit cards, interest, and pre-authorized payments	Verbal group discussion, sharing of lived experience, writing and drawing answers for the workbook, and reading Dennis′ stories

Co-Design Session 6	Review of the entire workbook, discussing concepts that have been taught, and design suggestions	Verbal group discussion