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Pictorial Representation of Abstract Financial Concepts to Foster Financial Literacy

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Abstract

Financial literacy is crucial for making sound financial decisions and living a better life. However, the field of finance is full of abstract concepts, such as inflation, liquidity, asset allocation and credit. Abstract concepts may be harder to comprehend than concrete concepts. This is because abstract concepts lack tangible referents in the physical world, whereas concrete concepts (e.g., car or house) have a palpable form and can be directly experienced through our senses. Against this background, the question arises of how instructional material can be designed in a way that helps people acquire knowledge about abstract financial concepts. Multimedia learning theories suggest complementing verbal information with pictures that represent the respective topic or concept. Since abstract financial concepts lack palpable, concrete forms, these representational pictures are not simply available but have to be developed. Based on grounded cognition theory, this article discusses three approaches, including ‘situations’, ‘emotions’ and ‘metaphors’, which can be used to generate representational pictures of abstract financial concepts. This study aims to enhance our understanding of how to make effective pictures of abstract financial concepts and thus multimedia learning material, which in turn supports increasing people’s financial literacy.

Keywords: Abstract Financial Concepts, Financial Literacy, Multimedia Learning, Pictures, Financial Education

1. Introduction

Financial literacy is crucial for making sound financial decisions and living a better life. The benefits of financial literacy have many shapes and forms, which also include higher financial inclusion, which in turn directly supports the overall economy (Ahmad et al. 2021). Financial illiteracy, in contrast, may lead to poor retirement planning, mismanagement of financial assets, over-indebtedness and taking on high-interest debt (Lusardi and Mitchell 2014). The need for a financially literate society is even more evident, since today’s social and financial systems pressure people to individually take responsibility for important financial decisions related to savings and investing, post-retirement financial security, health care or home buying (Alqahtani 2018). More challenges are the increasing complexities of financial systems and the digitisation of financial services, which, despite offering a huge number of benefits, still put a twofold burden on learners, especially those who have low prior financial knowledge: one, to learn about finance, and two, to learn financial technologies.

However, given the importance of financial literacy, many people find it a difficult subject to learn and fail to have even rudimentary knowledge of finance (Goyal and Kumar 2021). Studies show that about 3.5 billion people around the globe are financially illiterate (Klapper, Lusardi and Oudheusden 2015). Less than half of young adults (aged 23–27) understand concepts such as interest compounding, inflation and risk diversification (Lusardi, Mitchell and Curto 2010). As seen in Sweden regarding the pension system, it took more than a decade of governmental campaigns, after which only 40% of the contributors recognised that, in the new system invented in the 1990s, the pension fund would be based on lifetime earnings (Larsson, Sundén and Settergren 2009). In the Netherlands, 79% of citizens believe that those who are currently employed pay the pension of those who are already retired (Pensioenfederatie 2016). This is an incorrect mental model, and the correct conceptualization is that Dutch employees gradually accrue their own retirement income. Such misunderstandings can lead to precarious financial decisions that may result in substantial financial losses. The results may be explained by the fact that many concepts in finance are highly convoluted and abstract. Abstract financial concepts (AFCs) lack palpable, concrete forms that can be directly experienced through the senses.

To improve financial literacy, the meaningful learning of AFCs should be fostered. Multimedia learning theories such as the cognitive theory of multimedia learning (CTML) (Mayer 2005), which is an influential theory in its field, suggest including representational pictures along with words in instructional materials. Usually, financial information is presented in the form of text and numbers only (Schroeder et al. 2020). Graphs are also extensively used, but to understand graphs, prior knowledge of financial constructs and imaginative capacity is essential in most cases. According to the CTML, the rationale for adding pictures is that they open up the visual resources of the mind that aid in better understanding the concepts. However, the question arises of how to generate representational pictures of AFCs, such as pensions. It is comparatively easy to make pictures that have a concrete form, such as a house, a car or a bed. In contrast, AFCs such as risk diversification, market value, compound interest and asset valuation do not have a defined physical shape. Thus it is more difficult to picturize those concepts. Prior scientific contributions have rarely focused on visualising such AFCs to improve learning.

This study describes three approaches, namely situations, emotions and metaphors, to make representational pictures of AFCs for enhancing meaningful financial learning, especially for those who have low prior knowledge. These approaches match the ideas of grounded cognition theory, and although they may not be exhaustive, they are based on studies from other domains where they have been used relatively extensively. In addition, these approaches are likely to support making pictures of AFCs because they are close to visual sensory experiences. This study may support researchers and educationalists whose focus is on making financial education more effective. In particular, it may provide ideas for making pictures of AFCs for learning purposes, to further test and possibly develop

them. It is important to note here that this stream of research in finance is very new, and so it may appear as equivocal. However, the need to make representational visuals in finance is so important that we dare introduce our ideas.

2. Learning Abstract (Financial) Concepts

2.1. Abstract Financial Concepts

An abstract concept is often described as one that lacks a tangible referent in the physical world (Paivio 1965). In almost all theories about the meaning of abstract concepts, the lack of physical attributes or physical substance is an important component (De Koning and Tabbers 2011). They are commonly defined as “entities that are neither purely physical nor spatially constrained” (Barsalou and Wiemer-Hastings 2005). Concrete concepts, in contrast, can be experienced through our senses of sight, smell, sound, taste or touch. This means that the connection between concrete concepts and perceptual referents is straightforward, whereas the same does not apply to abstract concepts. Consequently, abstract concepts might be harder to learn compared to concrete concepts (Zuckerman, Arida and Resnick 2005). Against this background, the question arises of whether and how it is possible to find perceptual referents of abstract concepts to help people learn abstract concepts. According to CTML, we specifically focus on visual representatives (i.e., representational pictures of abstract concepts). According to cognitive science theories, meaningful learning occurs when people learn with words and representative pictures that support the learning text, as compared to presenting the learning material only in the text (e.g., Boadum 2020; Çeken and Taşkın 2022). We have to take in mind that the ‘representative’ is dependent upon what people agree on for assigning something to something else.

For example, most people would agree on what a banknote looks like. It is usually made of paper with numbers on it, referring to its amount. There is a photo of an important person or place printed on it, along with different designs. It can be put in a pocket, or it can be kept in a wallet or purse. If a picture of such a thing is shown to someone, the answer would likeliest be that it is a banknote. This is because we recognise and represent banknotes with such properties. If we ask different people to make a pictorial representation of ‘financial risk’, it is likely that the picture is different for each individual. This is because ‘financial risk’ does not have a concrete form; it is abstract and cannot be experienced through our senses as a whole concept. Whereas the ‘banknote’ has a concrete, palpable form that is experienced through our senses of taste, smell, sight, touch and sound, and so we have a similar representation of this object. Thereby, the pictures of ‘financial risk’ would differ much to the extent that, if a person aims to make one, it would be representational for that particular individual and would be irrelevant for someone else, despite being a picture of the same concept.

Thus, such abstract concepts in finance are not straightforward enough to make pictures of them, which obstructs learning and directs towards the need for new ideas of making visuals of AFCs that could convey the same meaning across different learners and be representational pictures. This would enhance the presentation of financial concepts that may improve the meaningful learning of finance. In addition, it will support the implementation of multimedia learning theories in financial education.

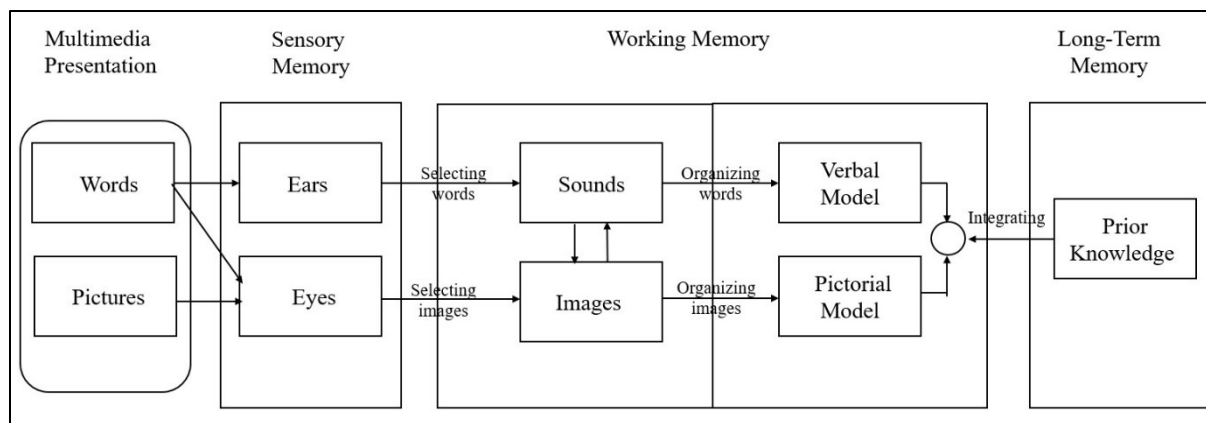
2.2. The Role of Pictures in Learning Concepts

To foster meaningful learning, CTML suggests presenting instructional material with both words and relevant pictures instead of words only (Mayer 1997). CTML is based on the notion that there are two different channels for processing information in the human brain: one processing visual information and the other processing verbal information (Mayer 2005). This view asserts that words and pictures are two distinct modes of presenting the same information. The characteristics of both modes are inherently different from each other (Fein 2017). Pictures can be categorised as an original form of information, as opposed to an interpretative form, because pictures can represent material in a form closer to our visual sensory experience or in an as-it-is form. The learning material can be described in words and depicted in pictures; both can complement but not substitute for each other (Mayer 2002).

Based on the CTML, various principles for the design of instructional materials have been developed and tested (for an overview, see Mayer and Fiorella 2014; Mayer et al. 2018). The basic, and at the same time, the principle of utmost importance, is the so-called multimedia principle, which advises the presentation of instructional material in multimodal form using words and pictures instead of words alone. The importance of this principle results from the fact that it directly regards dual coding processes in the human brain. Dual coding suggests that human cognition has two processing systems: verbal and pictorial (Paivio 2014).

According to CTML, the human brain consists of sensory memory, working memory and long-term memory. Information presented in words and pictures is perceived with the eyes and ears. Only selected information is processed further into the working memory as sounds or pictures, whereby sounds can be translated into pictures and the other way around. In working memory, information is organised into separate cognitive representations, that is, verbal or pictorial models. Afterwards, these newly developed cognitive models have to be integrated with the relevant prior knowledge from the long-term memory in order to result in meaningful learning (see Figure 1).

Figure 1. The learning process defined by the CTML (Mayer 2003)



However, an important prerequisite of the multimedia principle is that the pictures should be relevant and represent the learning material (Mayer 2005). If pictures were not representational, then they would be categorised as irrelevant. Irrelevant pictures are considered extraneous material that competes for limited cognitive resources. It deviates learners' attention from the essential material and thereby obstructs deep learning (Zu et al. 2020; Cavanagh and Kiersch 2022). In particular, this may hinder the process of organising learning materials in working memory and may result in connecting or integrating the material with an incongruent theme (Moreno and Mayer 2000). In addition, if the multimedia principle is applied to learning material, and using this material does not result in better learning compared to just-word materials, then most of the other principles of CTML would not work as well (Fletcher and Tobias 2005).

Although the multimedia principle of CTML suggests adding relevant pictures to verbal material, it does not explain how pictures are deemed relevant to learning materials. In the case of AFCs, it is challenging to make representational pictures. This problem is exacerbated when the knowledge of making representational pictures of such concepts in finance is severely limited, if it exists at all. Thus, given the challenge of making representational pictures of these concepts and the lack of knowledge concerning this issue in financial learning, it is likely that pictures would be based on mere guesswork and could emerge as nonrepresentational. In other words, it is difficult for designers and educators to create pictures of AFCs that could be relevant and represent financial learning material. To contribute to solving this problem, we present three approaches that aim to explain how concepts can be learned. In addition, the approaches provide some hints regarding generating relevant pictures of AFCs that will improve the application of CTML principles in the financial learning context.

3. Picturing Abstract Financial Concepts

3.1. Grounded Cognition Theory

In cognitive sciences, the traditional theories of cognition suggest that, in modal systems of the brain, the representations of concepts (both concrete and abstract) convert into amodal symbols and are stored in the semantic memory (Anderson 1983; Mahon and Caramazza 2009; Tyler et al. 2001; Tulving 1983).

The knowledge stored in the semantic memory is detached from the perception, action and introspection of the brain's modal system. Common examples of such theories are semantic network models (Collins and Loftus 1975; Quillian 1969) or different forms of connectionist network models (Caramazza et al. 1990; Devlin et al. 1998; McClelland and Rogers 2003). The amodal theories stem from the early twentieth century, when behaviourists largely rejected nineteenth-century studies of introspection and excluded imagery from much of the psychology field due to assumed weak scientific foundations (Watson 1913). However, these streams of theories pose a lesser understanding regarding which system stores amodal symbols in the brain and how neural principles of computation and amodal symbols could be consistent (Barsalou 2008).

In contrast, grounded cognition rejects this classical view and suggests that, instead, all concepts are rooted in perception and action (Barsalou and Wiemer-Hastings 2005; Gallese and Lakoff 2005; Kiefer and Pulvermüller 2012; Martin and Chao 2001). The conceptual representations are hypothesised to form through the modality-specific representations of external (perception) and internal states (proprioception, emotion and introspection) and actions. Grounded cognition categorises theories that correspond to the relevance of sensory-motor systems, introspection and emotional states to experiential information (Barsalou 2008). Different accounts of grounded cognition show the roles of the body in cognition, which is based on the background that the bodily state influences the cognitive state (e.g., Barsalou et al. 2003; Lakoff and Johnson 1980) and the roles of simulation in cognition (e.g., Barsalou 1999; Decety and Grèzes 2006). The simulation is the rebuilding of motor, perceptual and introspective aspects or states acquired through the environment, body and mind during an experience.

Modality-specific representations are automatically activated in cognitive processing in both top-down and bottom-up approaches. Top-down triggers are related to task demands that activate modality-specific representations. In addition, in bottom-up processes, the same regions are stimulated. Examples of bottom-up approaches are word class (Perani et al. 1999), conceptual category (Trumpp, Traub and Kiefer 2013) and psycholinguistic variables (Lewis and Frank 2016) that influence conceptual processing. They have been observed in conceptual tasks, including lexical decisions (Kiefer et al. 2008), passive viewing (Trumpp et al. 2013) and visual masking conditions (Trumpp et al. 2014).

According to grounded cognition, conceptual characteristics are thoroughly rooted in our perceptions of actions in the physical environment and in our bodies. It explains that people make images of concepts (both concrete and abstract) in their minds, wherein the sensory-motor region activates in the brain when people think. The thoughts could be 'mental images', 'imagined movements through space' or imagined 'simulated sequences of actions'. For instance, the verb "kick" is understood through the motor regions of the brain, which is activated when a "kick" is physically performed (Hauk, Johnsrude and Pulvermüller 2004). This highlights that a greater number of factors play a role in the comprehension of

all types of concepts. Barsalou (2008) explained it as an interaction between perception, action, body and environment.

Since the idea is gaining traction in contemporary theories of cognition that thoughts are not comprised merely of words or symbols but of visual and motor images (Glenberg 2015), it is then perhaps possible to represent AFCs through pictures that people can relate to and that are representational. The rationale is that if the perceptual referents of body and environment could be added into the development of AFCs' pictures, it could be possible to generate representational pictures that may support financial learning and decision making. As discussed, grounded cognition theory suggests different ways in which abstract concepts are processed. In the context of making pictures, we have selected three relevant approaches to highlight and discuss that can be used to create representational pictures of AFCs. These include situations, emotions and metaphors. It could be argued that there are other ways, too, through which abstract concepts are processed, but the three selected approaches are close to perceptual referents; thus, they are suitable for translating into easily understandable pictures compared to, for instance, introspection.

3.2. Three Approaches to Picturise Abstract Financial Concepts

3.2.1. *Situations*

The situation-specific view of abstract concepts emphasises that the situation is part of learning such concepts (Schwanenflugel, Akin and Luh 1992). Whereas concrete concepts are relatively clearly entrenched in time and space, abstract concepts lack situational referents. Nevertheless, this does not mean that learning abstract concepts cannot be related to real-world situations. In fact, the representation of abstract concepts depends on complex interactions occurring in space and time (Zwaan 2016). Thus, knowledge of situations is an essential component of learning and using abstract concepts. Although the link between tangible perceptual referents and abstract concepts is not as direct and clear as for concrete concepts, situation-based perceptual information is part of many abstract concepts (Davis, Altmann and Yee 2020; Pecher and Boot 2011). The situation-based view of abstract concepts argues that concepts are not present in a vacuum (Schwanenflugel 2013); they exist in a situation, and it is difficult to understand them apart from one's situated experience. The concept of 'joy' can be understood, for instance, in a situation when a person experiences high profits on a particular investment opportunity.

For the comprehension of concrete concepts, situations play a background role, such as a chair in an office compared to one in a restaurant. Conversely, many abstract concepts are themselves facets of a situation (van Oers 2001). The meaning or sense of an abstract concept, then, is relatively unclear when it is presented out of context, as its meaning relies on objects, actions, people and settings that are together considered as situation (Wilson-Mendenhall et al. 2011). To state it differently, while both

abstract and concrete concepts individuate facets of a situation to classify the world around us in a manner that we can understand (Barsalou 1999), the semantics of an abstract concept are low in isolation and can differ significantly based on the situation.

McRae et al. (2018) tested whether pictures of situations facilitated the learning or processing of abstract words. They conducted two experiments and applied a lexical decision task. In the first experiment, relevant and irrelevant pictures of situations were presented, followed by abstract words for which the participants had to decide whether they matched the preceding pictures. For instance, a picture of two kids sharing food illustrated the abstract word 'share' (see Figure 2a). In the second experiment, relevant abstract words and pictures, along with irrelevant abstract words and pictures, were presented. First, abstract words were presented and then their pictures, whether relevant or irrelevant. Participants were asked to decide whether the picture depicted a situation that matched the preceding abstract word. For instance, an irrelevant picture in Figure 2b is paired with the abstract word 'convocation'. However, this picture shows a woman buying groceries and a musical instrument that is bizarrely placed against the shelf, so clearly, this picture does not represent a situation of 'convocation'. The results of both experiments showed that decision latencies were significantly shorter for pictures and abstract words that were relevant to each other, meaning that the picture represented the word. This study provides evidence that pictures of abstract concepts based on situations are favourable for comprehending these concepts.

Figure 2. Pictures of abstract concepts based on (a) congruent and (b) incongruent situations (McRae et al. 2018)



Wiemer-Hastings and Xu (2005) analysed the role of situations in understanding abstract and concrete concepts in a different manner. They conducted a feature listing task using several abstract and concrete concepts in an experimental study, in which participants had a choice to list either the item's own properties or relevant situational properties for each abstract and concrete concept. They produced a huge amount of situational information for abstract concepts. This means that the listed properties of abstract concepts were related to experiences, specifically social contexts, which is a situation-based view of processing abstract concepts (Roversi, Borghi and Tummolini 2013).

3.2.2. *Emotions*

The use of emotions is another possible approach for making pictures of AFCs. Although no study has directly examined the role of the emotional content of abstract concepts in the form of pictures in fostering learning, other relevant investigations may provide prospects for the idea. The study by Ponari, Norbury and Vigliocco (2020) suggested that emotional valence (either positive or negative) provides a ‘bootstrapping mechanism’ in the learning of abstract concepts. In this study, one group of participants received abstract words emphasizing emotions. The other group, in contrast, received these concepts in a neutral state, providing more ‘encyclopaedic, non-emotional’ information. For example, ‘reform’ was used as one of the abstract concepts. The emotional version was, “I am extremely cross about the government’s planned ‘reform’ of the health service, which is hugely unpopular. The change will make health care worse, and many people will suffer” (Ponari, Norbury and Vigliocco 2020, 12). The encyclopaedic version of this concept was, “I read an article about the government’s planned reform of the health service, which will take place next year. They are often changing things, and many people will change jobs” (Ponari, Norbury and Vigliocco 2020, 12). The results showed that emotional valence supports the acquisition of abstract concepts compared to non-emotional information, which, in a relative measure, performed poorly.

Park et al.’s (2015) eye-tracking study examined the influence of emotional learning designs on learning achievement. Participants received learning material with and without anthropomorphism (see Figure 3), which included emotional facial expressions of lifeless objects. Anthropomorphism was used to induce positive emotions in the learning material. The eye-tracking data showed that the learners’ attention was acquired in learning materials with anthropomorphism, which resulted in the highest learning outcomes. In a similar study, Uzun and Yıldırım (2018) applied emotional design to instructional material and assessed it on various factors crucial for better learning. The learning material was comprised of science topics, including work, energy and energy conservation. They used an experimental method in which four different treatments were applied to four different groups. The findings indicated that emotional design features lead to less mental effort, more positive emotions and better recall.

Figure 3. Instructional material with and without the use of anthropomorphism (Park et al. 2015)



The English translation of “Wie Immunisierung funktioniert” is “How immunisation works”.

3.2.3. Metaphors

Metaphors are known to be a potent technique for the effective learning of abstract concepts. The comprehension of abstract concepts is supported through metaphors driven from concrete domains; thus, metaphors aid in gaining a better and in-depth comprehension of abstract concepts by connecting them to concrete, physical experiences (Lakoff and Johnson 1980). They are used in a way that lets people apply their knowledge of the base that is more concrete to enhance their understanding of the target that is more abstract (e.g., Holyoak and Stamenković 2018; Veale, Shutova and Klebanov 2016). For example, financial markets are often described metaphorically as ‘a bull market’ and ‘a bear market’. The bull shoves its horns upwards, whereas a bear swipes its paws down towards the ground. These actions are used as metaphors for describing the movement in financial markets. If the prices are going up, then it is a bull market; if they are going down, then it is a bear market.

Language plays an important role in generating and understanding metaphors, wherein both target and source domains are verbal (Thibodeau, Matlock and Flusberg 2019). Yet, metaphors are not limited or exclusive to verbal boundaries for understanding abstract concepts (Refaie 2003, 76). Lakoff and Johnson stated that “the essence of metaphor is understanding and experiencing one kind of thing in terms of another” (Lakoff and Johnson 1980, 5). This denotes that abstract concepts can be represented in non-verbal ways too, because, as discussed, people understand abstract concepts in terms of more concrete phenomena (Ge, Mao and Cambria 2022). The description of ‘concrete’ here refers to objects that can be perceived through senses or experienced through bodily interactions. Thus, the abstract concept (the target) that needs to be comprehended is compared to an object (the base) that can be touched, seen, heard, smelt, tasted or experienced through physical actions. Taking this further, metaphors of abstract concepts can be depicted in pictures that may represent those concepts (e.g., Forceville and Renckens 2013; C. Forceville 2017) and considered relevant pictures because of their representativeness.

Forceville and Paling's study (2021) provides evidence that visual metaphors can be used to explain abstract concepts. It included an abstract concept of 'depression', in which the authors analysed nine short animated films on depression. These films did not use any words but only used visual metaphors to describe the abstract concept of 'depression'. The authors used Lakoff's (1993) theory of object–location duality to analyse the films. This theory suggests two ways, object and location, through which people conceptualize abstract ideas in metaphorical form. The 'object' here shows what one can possess for abstract concepts, for instance, "I have finally found love". The 'location' refers to a place one can be in for such types of concepts, for instance, "I am in love". By analysing the films, the authors concluded that they feature two dominant metaphors: (1) "depression is a dark monster" (object) and (2) "depression is a dark confining space" (location). In one of these films on depression (Figure 4), a cloud first appeared on a young man and then began to rain. Later, the man takes action to solve this problem by going to a psychiatrist who, in vain, tries to destroy the clouds. Then, the raining clouds merge with the raining clouds of the other person. Finally, after a while, the clouds start to fade away. In this film, it is cued that the cloud is depression, the rain is (alcohol) drinking, and merging of raining clouds with the other person is the collective problem of depression and drinking. The authors concluded that animations or visuals provide affordances for presenting metaphors in a multimodal form that can represent abstract concepts.

Figure 4. Animation of an abstract concept of 'depression' (Forceville and Paling 2021)



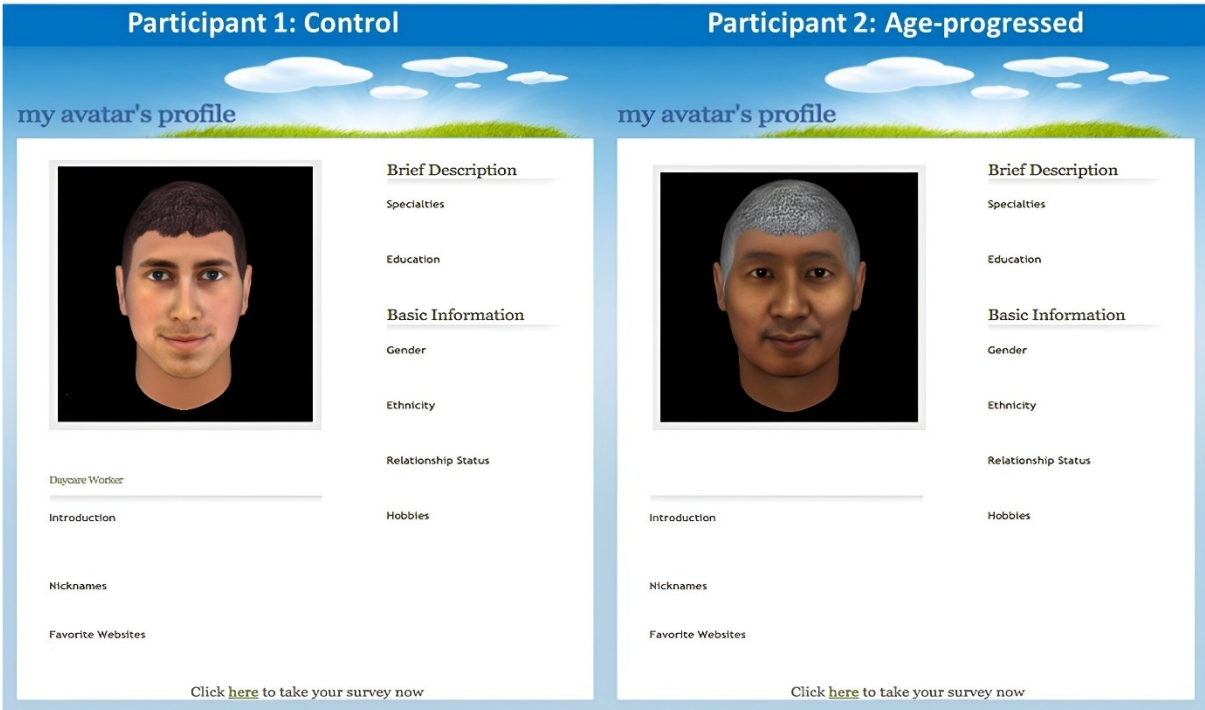
3.3. Illustrating the Use of the Three Approaches for Picturing Abstract Financial Concepts

For the purpose of providing hints with regards to how pictures of AFCs could be generated using situations, emotions and metaphors, this section presents a few possible ideas or directions, starting with situations that play a crucial role in defining and making pictures of abstract concepts and their meanings that may change across different situations. This may apply to the financial context of making pictures of AFCs. For example, the concept of 'credit' is broadly defined as money borrowed from a lender by a borrower. There are various sub-categories of credit, such as 'revolving credit' and 'instalment credit'. The revolving credit that is common in credit cards permits you to borrow up until a specified amount of money, and once a borrower repays that amount, he/she can borrow again. Instalment credit is mostly used for long-term loans, such as home mortgages. This includes a large amount of money to borrow, fixed monthly payments and a standardised timeframe of repayment. The situational elements of revolving credit are different from those of instalment credit. In the former, there is a type of card, and

set amount that can be borrowed without much prior scrutiny; it can be recharged typically through online banking or an automated teller machine (ATM). An instalment credit usually involves a higher amount, a banker that will scrutinise the application of a borrower, and a long-term asset. Thus, if pictures of these two concepts are generated following the relevant situational properties of each concept, then these pictures may be deemed representational or relevant to that particular concept, which may eventually assist in learning these AFCs.

Another idea for generating situation-based pictures could be from Sims et al.'s (2020) study. They examined the challenges of young people regarding their difficulty in visualising their future selves, which hindered their preparation for post-retirement funds. The study applied experimental research, in which participants were shown their age-progressed avatars in the treatment group and their same-aged avatars in the control group (see Figure 5). They were shown these pictures while taking a financial education course. The results of the financial literacy test revealed that participants receiving age-progressed avatars gave more correct answers and displayed higher confidence (i.e., fewer "don't know" responses). Moreover, they reported an interest in attending long-term financial planning programmes. Drawing from this research study to explain the importance of planning for post-retirement funds, pictures of an elderly person, for instance, can be generated in a comparative manner. One picture may show the miserable situation of an old person where he or she did not plan for retirement; another picture could display the joyful situation of the same old person where post-retirement was planned well in time.

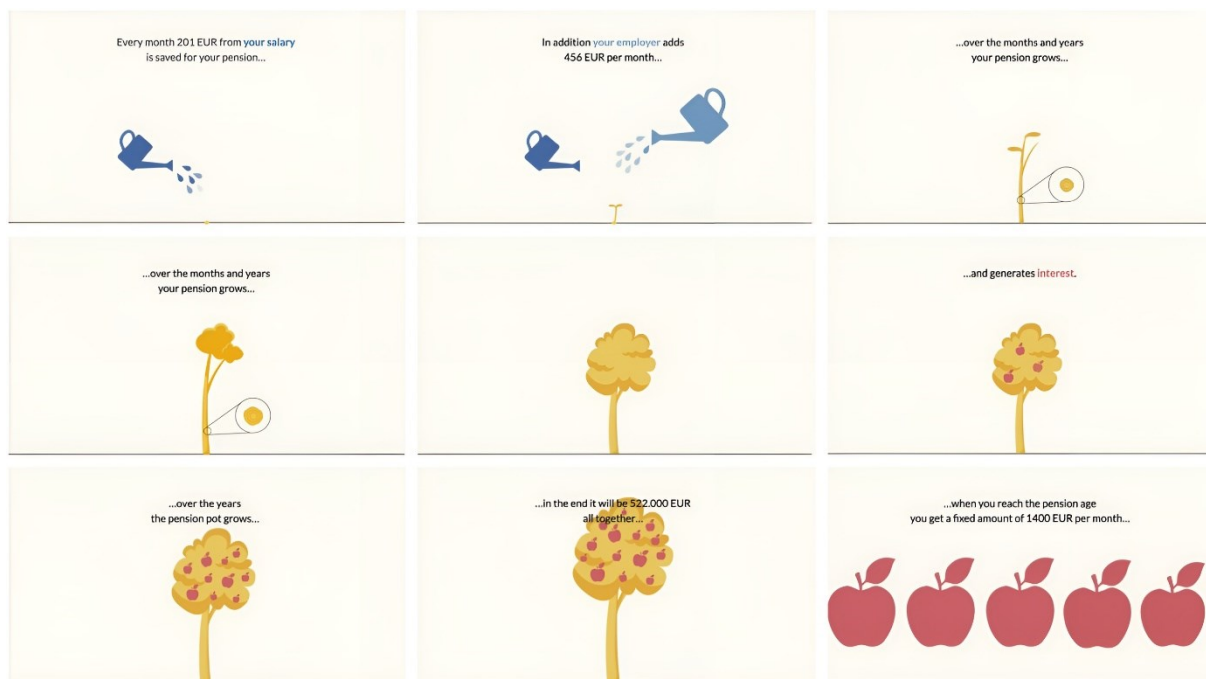
Figure 5. The non-aged (left) and aged-progressed (right) avatar of the same person (Sims et al. 2020)



Emotions: Since emotions can be perceived through the senses, and their use is considered prominent in processing abstract concepts, emotional pictures have the potential to represent AFCs and foster learning. Moreover, financial matters are intensely stitched into people's lives; thus, these matters invoke a variety of emotions. Gaining profits from investments is considered a positive occurrence associated with happy emotions. Similarly, losses in finance are related to negative emotions, such as sadness or anger. Fear and greed are considered emotions that override rational thinking and often lead to incorrect financial decisions (Gaies et al. 2023). Discussing money is taboo in many different cultures and hinders financial planning and learning (White et al. 2021); it is associated with the emotions of shame or fear (Sadek 2020). These and other such emotions in finance can be used and instilled in generating pictures of AFCs that may enhance the processing and learning of such concepts.

Metaphors: Recent studies in financial literacy have investigated visual metaphors of financial concepts as a unique method to foster learning through pictures. Van Hekken and Das (2019) used the 'navigation metaphor' as a visual for communicating about the basics of pension accrual. Schröder et al. (2022) incorporated the visual metaphoric storytelling of pensions using a tree metaphor (Figure 4). This metaphor shows a set of different stages that starts with watering the ground; then a plant pops out, which eventually becomes a whole tree and starts giving fruit. This represents the early planning of post-retirement funds that accumulate over time, and when the person retires, he/she starts to receive a pension. Both studies discuss the challenge for people to understand financial concepts, particularly the prevailing way of communicating financial information that is mostly text, numbers and graphs that hinder effective learning. However, these studies did not discuss in detail the abstractness and concreteness of financial concepts. This is important because they influence the making of pictures of financial concepts, as people visualise these two types of concepts differently. Moreover, while visual metaphors are informally used in the learning of financial concepts, this type of usage is similar to using metaphors in everyday life situations to explain difficult topics. Visual metaphors as a technique for presenting complex concepts in financial education can be recognised only scarcely. This highlights the need for further research to refine them and make them more effective.

Figure 6. Visual metaphoric storytelling of the concept of 'pension' using a tree metaphor (Schröder et al. 2022)



4. Discussion and Conclusion

Today's social and financial systems pressure people to individually take responsibility for important financial decisions related to saving and investing, post-retirement financial security, health care or home-buying (Alqahtani 2018). However, regardless of the importance of this topic, people are remarkably low in financial literacy (e.g., Artavanis and Karra 2020; Dewi et al. 2020). Consequently, financial education programmes have surged around the world with the aim of increasing financial literacy. The potential of financial education is immense and can improve people's financial decisions (Hastings, Madrian and Skimmyhorn 2013). Moreover, it can also aid in securing their futures from economic uncertainties (Frisancho 2020).

Given the relevance of financial education, several interventions have emerged with the intention of building effective programmes. Particularly in recent times, the inclinations of these programmes have shifted towards incorporating digital technologies. These include, among others, game-based learning (GBL), online education and learning on mobile apps. GBL is an effective method that has attracted interest across different disciplines. Increasing financial literacy has been found to be a favourable technique (Platz and Jüttler 2022). Plentiful evidence suggests that learning through games has been successful in building financial knowledge (e.g., Nadolny, Nation and Fox 2019; Platz, Jüttler and Schumann 2021). Regarding online financial education, Blanco et al. (2023) developed a digital financial education programme called Mind Your Money (MYM) to improve financial capability and reduce financial stress among low-to-moderate income earners. Similarly, mobile apps are gaining popularity within the financial education domain. Many innovative financial literacy apps are emerging in marketplaces such as the Google Play Store and the Apple App Store.

While such financial education programmes are emerging rapidly, meta-analyses show that they are not as effective as they should be (Kaiser and Menkhoff 2020; Miller et al. 2014). This study aims to support these financial education interventions by analysing the ways in which representational pictures of AFCs can be generated. Pictures significantly enhance learning outcomes (Andrä et al. 2020; Renkl and Scheiter 2017). However, simply adding pictures may not automatically result in successful learning. This depends on the type of pictures and the ways in which the text of the learning material is represented by those pictures. In this regard, multimedia learning theories provide extensive accounts for designing learning materials that may fit mental structures. Similarly, to make optimal use of human cognitive architecture, pictures of abstract concepts should be generated in ways that support the processing of these concepts. In this way, educational relevance could be enhanced and learning outcomes could be improved for different groups of learners and contexts of learning.

The three techniques discussed in this study are potential ways in which AFCs can be represented in the form of pictures. The situational view suggests that the situations or contexts in which abstract concepts occur play an important role in visualising them. The emotional view suggests that adding emotional elements supports visualising abstract concepts. Finally, the metaphor view proposes that abstract concepts can be visualised using the knowledge of concrete domains. While all of these techniques are unique to each other, no study has directly compared or provided evidence of the superiority of one technique over the others. However, each of these techniques may not be suitable for all types of AFCs. Perhaps a particular approach is suitable for particular types of AFCs, and another approach is more effective for other types of such financial concepts. Further research in this direction would provide a better understanding. Overall, these techniques show how abstract concepts are comprehended in a more dynamic form and their use to create pictures in finance to support learning.

The pictures of AFCs can be applied in both formal and informal contexts. In a formal context, they can be added to the learning materials along with the financial text, and learners may benefit from learning with pictures of AFCs. The informal learning context, however, may pose a special challenge for financial learning, in which pictures of AFCs might be supported. Informal learning is rapidly increasing in the field of financial literacy, particularly as more and more people tend to refer to the internet to learn about financial concepts and products whenever a need arises (Rudeloff 2019). The information on the internet is often extensive and unorganised (Morente-Molinera et al. 2019), which may impede learning, and the problem exacerbates as users have to navigate themselves and self-learn about financial topics online under an informal learning structure. Informal learning, with regard to objectives and procedures, is lowly structured, experiential and particularly not organised (Schürmann and Beausaert 2016, 131). This may have serious consequences because, if users do not learn about finance effectively or if their learning is inaccurate, it may impact their financial planning and decisions, which can cause them substantial financial losses. The pictures of AFCs may mitigate this issue, as representative pictures

are relatively easily understandable compared to complex financial equations or information in the form of text or graphs.

The current study may, among other things, benefit financial education programmes that use the latest educational technologies. This study presents a view of the method-based approach, in which instructional design is developed on the basis of ‘how people learn’ or where learners are placed at the centre. This is in contrast to the media-based approach, which keeps technology at the centre of instructional design, with less focus on learners. According to Mayer (2022), the method-based approach is more productive, especially in an era of rapid technological expansion. Finally, for future research, empirical studies testing these approaches to making AFC pictures would be an appropriate direction.

5. References

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