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The Educational Design Ladder and design thinking pedagogy: A customised training programme for creative problem-solving

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ABSTRACT

Purpose of the study: The paper aimed to help a Financial Services Organisation (FSO) develop a cost allocation product prototype using design thinking. Design thinking was explored as a pedagogy. Educational Design Ladder was used to create the customised five-day training programme qualitatively utilising the literature review section.

Design/methodology/approach: Empirical research was conducted to collect qualitative data using interviews to determine whether the participants successfully developed a cost allocation product prototype. The qualitative data was analysed using an Excel spreadsheet.

Findings: The interviews tested the success and possible shortcomings of the customised design thinking training programme. The major limitation is that only one department in a single FSO was involved in the training and its members interviewed. The results can therefore not be generalised.

Recommendations/value: The recommendation was that the Educational Design Ladder be used as an innovative resource/model for design thinking pedagogy.

Managerial implications: When design thinking is used for the first time, more time should be given for participants to experiment with the process and get used to the steps, tools, and templates. Design thinking is a feasible and sustainable strategy to use to seek a competitive advantage using customer insights and innovation based on collaboration.

Keywords

Creativity; Facilitation; Innovation; Prototyping; Reskilling; Upskilling

JEL Classification: M53

1. INTRODUCTION

The World Economic Forum's (WEF) Future of Jobs Report (2020) lists the top 10 critical skills and skills groups that employers have identified as essential for work by 2025. The skills are (1) analytical thinking and innovation; (2) active learning and learning strategies; (3) complex problem-solving; (4) critical thinking and analysis; (5) resilience, stress tolerance, and flexibility; (6) creativity, originality, and initiative; (7) leadership and social influence; (8) reasoning, problem-solving, and ideation; (9) emotional intelligence; and (10) technology design and programming. The Fourth Industrial Revolution (4IR), the global COVID-19 pandemic, and the world's education system have created a highly uncertain outlook for the labour market and future work, and highlighted the urgency of upskilling (WEF, 2020).

Faced with internal and external problematic situations, greater emphasis needs to be placed on creative problem-solving skills in organisations linked to five of the skills from the WEF (2022) report listed above. Employers and employees need to develop their problem-solving skills and upskill themselves in these key areas in order to be able to adapt to and overcome the challenges in the "new normal", while thinking creatively and critically to ensure an innovative prototype as an outcome.

Design thinking is a pedagogy that uses the five skills (analytical thinking and innovation; complex problem-solving; critical thinking and analysis; creativity, originality, and initiative; reasoning, problem-solving, and ideation) and helps to generate compelling solutions to complex problems. This paper focuses on a case study involving the development and delivery of a design thinking programme in a financial services organisation (FSO) to develop and upskill employees in terms of the identified five skills. A limitation of the study is that the sample population was small and taken from only one FSO, meaning that the findings cannot be generalised. It nonetheless adds to the existing information about design thinking as a pedagogy in upskilling employees.

Managers realise the need to use facilitators (internal or external) in the upskilling process and often request customised programmes that provide practical, work-related training. Developing and upskilling employers and employees is not an *ad hoc* activity but requires an appropriate pedagogy to use over time. The 21st century educator or facilitator could include some of these leading innovative approaches in their pedagogical practices: the flipped classroom, project-based learning, collaborative learning, gamification, problem-based learning, design thinking, thinking-based learning, competency-based learning, spaced learning, self-learning, VAK teaching and crossover learning (Canina & Bruno, 2018; Metha, 2021). This paper reports on a case study in which the focus was on design thinking to develop the customised training programme for a FSO to create a cost allocation prototype. In addition, this paper highlights how the Educational Design Ladder assisted in planning this customised training programme using the design thinking pedagogy.

2. BACKGROUND AND PROBLEM

Businesses in the financial services industry are constantly looking for ways to optimise their business service mix to increase capital return and continue their cost optimisation journey (Krueger & Polvara, 2017). The path to cost excellence under current industry dynamics needs a comprehensive review of how costs are managed, instead of traditional cost reduction levers, such as eliminating management layers or branches. As a conventional exercise, cost allocation seeks to thoroughly distribute the overhead costs of an institution on an equitable basis, thereby determining the business's profitability at a granular level. The process often does not add value beyond that and is geared only to inform business units of their share (during the planning session and after the money has been spent). This process often creates significant internal friction due to the absence of cost transparency, particularly around consumption data and billing rules (Krueger & Polvara, 2017). The Corporate Finance Institute (CFI) (2020:1) explains that the cost allocation process involves "*identifying the costs objects in a business, identifying the costs incurred by the cost objects, and then assigning the costs to the cost objects based on specific criteria*". The aim is to allocate costs in the right way to enable the business to trace which specific cost objects are turning profits or losses. If costs are misallocated, even more resources may be further assigned to cost objects that do not yield profits.

There are several types of costs that an business must define before allocating costs to their specific cost objects (CFI, 2020). The three main categories are direct costs, indirect costs, and overhead costs. Direct costs can be attributed to a specific product or service, and they do not need to be allocated to the particular cost object. Indirect costs are costs that can be divided into fixed and variable costs. These costs are required for the operations and health of the organisation and are first identified, pooled, and then allocated to specific cost objects within the organisation. Overhead costs support the production or selling processes of the goods or services and are charged to the expense account. They must be continually paid, regardless of whether the company is selling any services (CFI, 2020).

The cost allocation mechanism is used to allocate costs to cost objects in two specific steps (CFI, 2020). The first step is to identify the cost objects for which the organisation needs to estimate the associated cost separately. The cost object can be a brand, project, product line, division, department, or branch. The second step is to accumulate the costs into a cost pool, pending allocation to the cost objects. Several categories can be used for the pooling of costs, based on the cost allocation base used. The existing cost allocation process did not provide sufficient data about cost utilisation in this specific FSO. The managers/ CFO need cost data for decision making; justifying the costs allocated; cutting allocated costs; and diverting the money to other, more profitable cost objectives. Moreover, the senior stakeholders of the business felt that the current cost allocation model did not allow for transparency and control over services rendered and the associated costs.

Given the above, the manager who commissioned the customised training programme wished to focus on design thinking to redefine the cost allocation process by viewing Transfer Pricing (TP) as a product, not as a process. The design thinking pedagogy was selected based on its potential suitability to develop a new cost allocation product prototype and to upskill participants. Krueger and Polvara (2017) suggests that a cost allocation framework should include overarching governance, a centre of excellence to orchestrate efficiencies and organisation-wide consistency, a service catalogue, a costing methodology, drivers linked to business fundamentals, data management, cost analytics, resolution and recovery planning, and tax and regulatory compliance. Kenton and James (2021) caution against the use of historical data to assume future performance, as the future performance of comparable cost items may diverge from historical performance and will therefore not reflect the performance impact of future transfer prices. The problem was that the business's current cost allocation model was not transparent and not well controlled, which led to the misallocating of equitable cost allocations. There was thus an urgent need for a new cost allocation model.

3. RESEARCH QUESTION AND RESEARCH OBJECTIVES

The main research question explored in this paper was: *How can the Educational Design Ladder and a design thinking pedagogy enable and equip participants to visualise a cost allocation product prototype in a FSO?*

To answer this research question, the authors set the following three research objectives for the customised training programme:

1. Explore design thinking and design thinking as a pedagogy.
2. Develop a customised design thinking training programme using the Educational Design Ladder.

3. Enable and equip the participants to visualise a cost allocation product prototype for further problem-solving.

4. LITERATURE REVIEW

Ruysenaar (2021:1) says that "*sweeping changes are upon us, the scale and speed of with are unprecedented in human history*." Our responses to these changes are often based on our prior learning and experiences. In addition, our problem-solving and thinking processes are often based on lower levels of Blooms- or SOLO taxonomies, which are remembering, understanding and applying. If faced with a problematic situation, with no clear ~~problem~~ definition and no ideal responses to it new 21st century pedagogies are needed to find better solutions. Collaboration is vital in these pedagogies, especially during analytical thinking and innovation, active learning and learning strategies, complex problem solving, critical thinking and analysis, resilience, stress, flexibility, creativity, originality, and initiative. One such pedagogy is design thinking because design thinking is a problem-solving method used to try and solve complex or wicked problems (Pusca & Northwood, 2018). Therefore, it is a practical pedagogy to use in training programmes due to its systematic approach to problem-solving (Alsaleh, 2020). To a great degree, this approach responds to the increasing complexity of modern technology and modern business.

4.1 Design Thinking approach

Design thinking can be defined as a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success (Brown (n.d.) cited in IDEO (2021). Liedtka (2011:3) adds that design thinking "*emphasizes observation, collaboration, fast learning, visualization of ideas, rapid concept prototyping, and concurrent business analysis*". Liedtka and Ogilvie (2011) describe design thinking as a method to identify hidden customer needs, and not merely as segmented target markets in demographical categories. Design thinking understands that human beings buy or use products and services. Brown and Wyatt (2010:32) believe that "*design thinking incorporates in-depth consumer insights and rapid prototyping, aiming to get beyond assumptions that block effective solutions*".

Design thinking can lead to fundamental innovation and requires a business to break away from its current mental model and regard every problem as a possibility or opportunity. Design thinking has multiple perspectives and layers that work across projects (Dorst, 2010) and converts problems into opportunities (Kimbell, 2011). Bjögvinsson *et al.* (2012:101) regard design thinking as a collaborative effort in which ideas are envisioned and explored in a handson way. Therefore, it is critical to plan any training programme carefully to ensure that knowledge sharing, collaboration, and insights are used effectively. Differences exist across design thinking definitions and processes. Beckman and Barry (2007) identify four steps and use the terms problem finding, problem selecting, and solution-finding. McKilligan *et al*. (2017:2) identify four terms, like Beckman and Barry (2007), as observation, the user employs frameworks for insights, development of ideas, and selection solutions.

4.2 Design thinking process, steps and tools

Liedtka and Ogilvie's (2011) design thinking model consists of a four-phase process, steps, and tools, as indicated in Table 1. This model was used for this study. We have added Amaan's (2018) views to expand on the four-phase process and tools used.

Table 1: Summary of the design thinking process

WHAT IS?	WHAT IF?	WHAT WOWS?	WHAT WORKS?
EXPLORE = EMPATHISE Involves research, insights, and design criteria	EXPLORE = VISUALISE Involves ideas, concepts, and napkin pitches	IDEATE = CO-CREATE Involves surfacing key assumptions and prototyping	BUILD = ITERATE Involves stakeholder feedback, learning launches, and on-ramps

Source: Adapted from Liedtka & Ogilvie (2011) and Amaan (2018)

Table three indicates the various tools used in the design thinking process and the various steps specifically. For example, these tools include mindmapping, brainstorming, concept development, rapid prototyping, and role-playing. These tools are essential to guide the design thinking process.

Elsbach and Stigliani (2018) organise design thinking methods into three broad categories: need-finding, idea-generation, and idea-testing tools. These tools can be used in combination Liedtka & Ogilvie (2011) and Amaan’s (2018) process, steps and tools. This is because need-finding tools include interviews with potential users of a design solution (e.g., interviewing potential customers), ethnography (e.g., observing and shadowing employees), or developing a holistic understanding of user experience (e.g., customer journey mapping). Idea-generation tools contribute to cultures of openness to ambiguity, risk-taking, and collaboration (e.g., group brainstorming, customer co-creation/co-design of initial ideas). Idea-testing tools contribute to cultures of openness to experimentation, openness to failure, and design-oriented strategic thinking. Idea-testing tools include rapid prototyping (i.e., developing quick models on a small scale to test ideas) and experimentation (i.e., testing some parts of a solution with actual users or internal testers).

4.3 Design thinking as a pedagogy

Design thinking as a pedagogy has gained much attention in education due to two facets and three dimensions. The two facets are that design thinking uses (1) descriptive models of the design process, based on observational research of real-life or laboratory design activities by individuals or teams; and (2) is a method to be practiced in industries that strive to introduce innovative products or services (Panke, 2019). The three dimensions are (1) design thinking in curriculum design, (2) design thinking as a teaching–learning approach, and (3) teacher training and support for design thinking. Design thinking therefore offers a valuable pedagogical mindset and approach. Furthermore, different skills are developed through design thinking education, such as prototyping skills, emotional skills, adopting perspectives, empathy, and a growth mindset. The development of these creative competencies leads to creative self-efficacy.

Design thinking can be applied to various educational settings, including customised training programmes for organisations, according to Panke (2019). It can be used

1. as a method for stand-alone scholarly discourses, and communities of practice are partly independent of design thinking (e.g., personas, sketch-noting, LEGO serious play, dynagrams),
2. as a method that interfaces with the methodical repertoire of qualitative research in general or ethnography in particular (qualitative interviews, observation),
3. as a method that interfaces with software development concepts such as rapid prototyping or early-stage end users testing ("experimentation"), or
4. for a method that was developed explicitly in design thinking, such as "Powers of Ten".

Teaching design thinking can be challenging in its early stages. However, there are far more benefits than barriers. The benefit of teaching design thinking is that students learn to develop a growth mindset, essential creative problem-solving, analytical, and spatial-thinking skills. The benefits go beyond knowledge, including valuable lessons in seeing setbacks as opportunities to learn, enhancing self-efficacy, appreciation for hard work and patience, enhanced collaboration, and forming entrepreneurial and community-minded behaviours.

There are, however, barriers in using design thinking in education. Panke (2019) identified limitations that include creative overconfidence or lack of creative confidence, wrong priority, shallow ideas, anxiety and frustrations, teamwork conflicts, sprint instead of a long-term focus, tension between learning content and design thinking process, and idea creation evaluation. The majority of educators want to learn the design thinking pedagogy as quickly as possible, yet it requires time to practise and receive expert feedback (Schell, nd). Design thinking is not an easy pedagogy to use, and most criticism of the method is based around ineffective design thinking instruction, limited time, and accelerated learning. This makes the design thinking pedagogy a complex problem in itself because it cannot effectively be used to teach a novice how to use human-centred design to solve complex problems. However, educators should focus on design thinking pedagogy that will adequately meet learners' needs.

Common themes can be identified using design thinking in formal education (Schell, n.d):

- instructional design method in course material development;
- curricular development technique;
- teaching strategy to achieve subject-specific learning goals;
- learning goal in and of itself;
- facilitation technique (mentoring, advising, counselling);
- method for process improvement or product development;
- approach for leadership and organisational development.

Bandura's four self-efficacy sources offer a checklist for design thinking educators. The first source is mastery experience, in which students engage in progressively desirably difficult challenges. The next source is vicarious experiences, which allow students to learn from their peers to get helpful information about their abilities to "do" design thinking. The third source is verbal persuasion, in which peers and facilitators offer feedback and support to students on meeting or exceeding standards. Praise is given for the effort and behaviours desired by the facilitator, as well as to students who are trying something new. The last source is physiological states, which refers to new learners' experiencing cognitive overload as new information is presented to them. The learners should therefore get the opportunity to de-stress and clear their working memory (Vogel & Schwabe, 2016)

4.4 The Educational Design Ladder

The Educational Design Ladder is "*an innovative resource/model that provides a process for the organisation and structuring of units for a multidisciplinary design thinking programme*" (Wrigley & Straker, 2015:374). The Educational Design Ladder was developed to show the content covered during teaching and learning activities and links well to design thinking. Using design thinking in education allows the educator to break down learning objectives into various difficulty levels (Panke, 2019), much like Bloom's taxonomy or the SOLO taxonomy. The five pedagogical stages of design thinking, and how these increase from lower to higher levels of complexity, can be developed using the Educational Design Ladder.

Each difficulty level consists of the following three aspects per step in the ladder, (1) the knowledge dimension (i.e., knowledge level, factual at a product and project level, conceptual level, procedural level, and beta-cognitive level); (2) SOLO taxonomy (i.e., from lower-order thinking to the highest level, higher-order thinking. It, therefore, moves from knowledge, comprehension, application, analysis, synthesis and evaluation); and (3) the design thinking level (i.e., empathise, define, ideate, prototype, and test) (Wrigley & Straker, 2015). All these levels appear in the Educational Design Ladder.

According to Wrigley *et al.* (2018), the Educational Design Ladder focuses on skill-based, effective, and cognitive outcomes. The skill-based outcome as a design thinking learning outcome is to conduct interviews. The effective outcome focuses on achieving attitudinal, motivational, self-efficacy, and goal setting that leads to creative confidence. The cognitive outcome focuses on verbal knowledge, knowledge organisation, and cognitive strategies.

The Educational Design Ladder has several implications for teaching and learning in design thinking courses (Wrigley & Straker, 2015). It involves peer learning and a peer teaching approach. The benefit to the learner is that knowledge is acquired through actions and practice, which encourage risk-taking, trying new things, attaining educational goals, cross-disciplinary exposure, developing and sharing skills sets, and solving real-world problems for real clients and with real responsibility.

5. METHODOLOGY

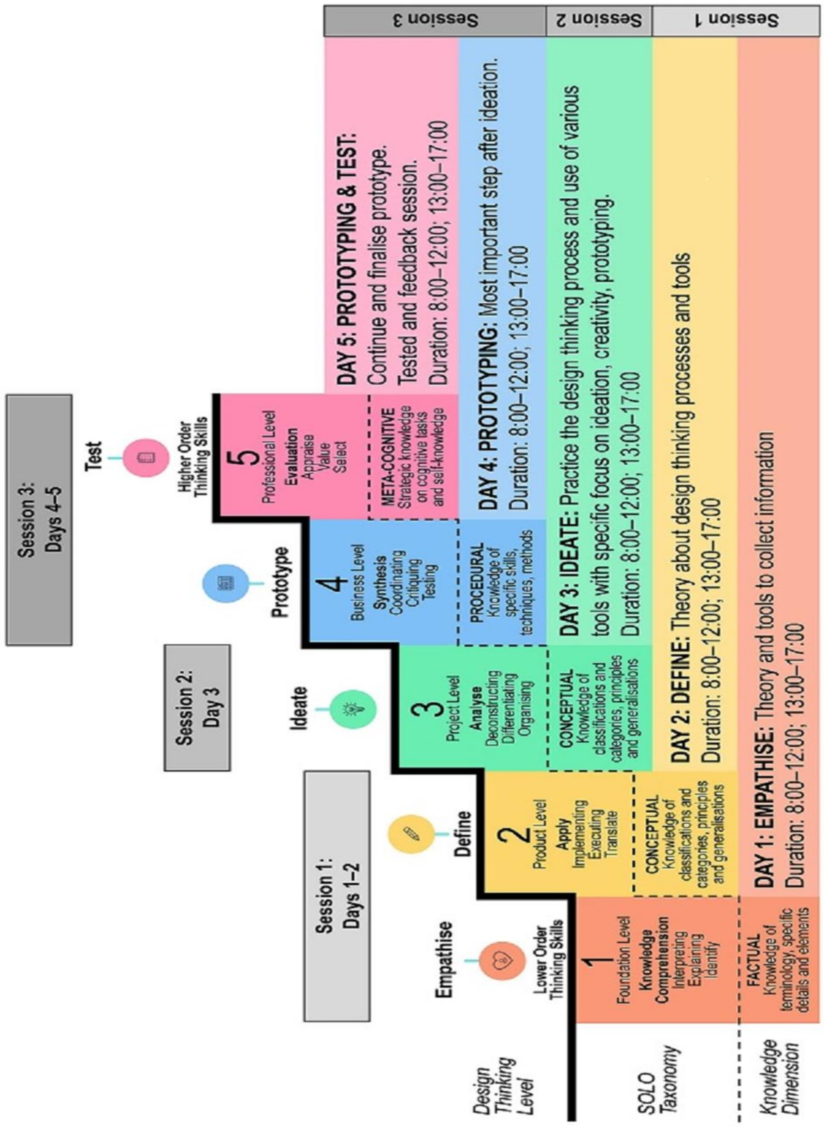
In response to the main research question of this paper, the Educational Design Ladder was used to develop a customised training programme incorporating the design thinking pedagogy for an FSO. The FSO was used as a case study. The research approach was deductive as it aimed at testing an "existing theory" (design thinking pedagogy and the Educational Design Ladder) during a training programme. The research was conducted at the offices of the FSO in South Africa. The study was qualitative because data were collected using a survey in the form of an interview as mono-method (the last day of the training programme). The interview schedule consisted of two open-ended questions due to time constraints on the fifth day. The focus on two questions only and asking these questions on the last day of the training may impact the trustworthiness. To overcome this, all the participants in the department (employees, line managers, and an executive manager) made themselves available to be interviewed. The non-probability sampling method (convenience sampling) was used in the study. The data were analysed using an Excel spreadsheet.

The facilitators used the Educational Design Ladder to develop a design thinking training programme for an FSO. The process started by meeting the managers of the FSO to determine their needs and what the learning outcomes should be. The researchers also had to know who would be attending the training and the time available for training. The point of departure for the training programme was that the problems the FSO faced should be viewed as opportunities, that customers' (sellers' and buyers') needs should be addressed, and that the solution should be co-created with the customers to ensure joint ownership of it. Current TP models show market segments and demographic categories as methodology and drivers, but fundamentally, people buy and accept services. By promoting empathy and understanding stakeholder needs, the design thinking approach may extract and improve the value of the current TP product and possible future product.

The facilitators were informed that 15 selected employees of the cost allocation team (the whole department) and four senior stakeholders (three-line managers and one executive manager) would be attending. The duration was 5 days. The managers expected a cost allocation product prototype as the outcome of the training, which was not possible due to the short duration of training. When design thinking is used for the first time, more time should be given for participants to experiment with the process and get used to the steps, tools, and templates. Only a visualisation (rough sketch) was possible. To understand the profile of the participants, information was obtained regarding their sex, language, and qualifications. The profile identified that more females than men would attend the training programme, that most of the participants were English speaking, and most had a bachelor's degree. This can be seen as a limitation of the study.

After obtaining the information, the Educational Design Ladder was utilised to consider the design thinking level, SOLO taxonomy, and knowledge dimension. Each step and level are essential in the Educational Design and Design Thinking stages, as indicated in Figure 1. The planning was essential to guide the participants from lower-order thinking skills to higher-order thinking skills to develop a prototype. The following points were taken into consideration in every step: (1) design thinking step, (2) SOLO taxonomy, (3) knowledge dimension, (4) learning objectives, and (5) activities and assessment.

Figure 1: Planning the training programme using the educational development ladder



Source: Own compilation, adapted from Wrigley & Straker (2015); Fuloria (2020)

The facilitator's role was to guide thinking, encourage participants to work innovatively, be forward-thinking, and use a customer-centric mindset. The focus was on creative problem solving during the 5 days. The facilitator considered the fundamental principles behind design thinking, according to Dam and Siang (2020:1), which were dealt with over the 5 days in the case study. Note that Dam and Siang does not give a 5-day timeline for the fundamental principles, but the researchers used the 5-day timeline as per the request of the FSO.

- Day 1: Design thinking starts with empathy and a deep human focus to gain insights that may reveal new and unexplored ways of seeing.

- Day 2: Reframing is essential in defining the problem and looking at things more holistically.
- Day 3: It is essential to encourage collaborative, multidisciplinary teamwork to leverage the skills, personalities, and thinking styles of many to solve multifaceted problems.
- Day 3: Divergent thinking styles explore as many possibilities as possible and open an ideations space.
- Day 3 and 4: Convergent thinking styles follow divergent thinking to combine and refine insights, select ideas, rapid-modelling potential solutions, and determine viability of solutions.
- Day 4 and 5: Test the prototypes and improve the design.
- Day 5: Empathetic frames of mind are revisited, and the challenge is redefined using the new knowledge and insight, until a desirable, feasible, and viable solution emerges.

After the planning was done, the researchers focused on the learning objectives, activities, assessments, and the various difficulty levels. The following programme for the training was compiled:

SESSION 1: DAY 1 OF THE TRAINING PROGRAMME

Step 1: Foundation Level – Empathise – Factual focus

Learning objective: After completing this step, the participants should understand design thinking and the value of the design thinking process.

Activities: Facilitation centred

Assessments: Multiple choice questions to test the acquired knowledge.

Steps: 1. Do research, 2. Identify insights, 3. Establish design criteria.

Tools: Persona cards, value chain analysis, 360 empathy, and mind-mapping

Research: Interviews with employees in the organisation and customers to uncover emotions and seek stories. Feedback regarding the interviews was provided in the second session (Day 3).

SESSION 1: DAY 2 OF THE TRAINING PROGRAMME

Step 2: Product Level – Define – Conceptual focus

Learning objective: After completing this step, the participants should understand design thinking, use the design thinking process, and use the various design thinking tools and templates.

Activities: Facilitation and group work. Groups to identify the human-centric problem statements, identify meaningful surprises and tensions, and infer insights. They need to then group these into specific consolidated statements, uncertainties, and understandings.

Steps: 1. Brainstorm ideas, 2. Develop concepts, 3. Create some napkin pitches.

Tools: Brainstorming and wish cards

Assessments: Overall team assessment and use of design thinking tools

SESSION 2: DAY 3 OF THE TRAINING PROGRAMME

Step 3: Project Level – Ideate – Conceptual focus

Learning objective: After completing this step, the participants should use their collective creativity to generate ideas for the prototyping level.

Activities: Brainstorming, building on, and grouping each individual's ideas into categories

Steps: 1. Surface key assumptions, 2. Make prototypes.

Tools: Assumption testing and prototyping

Assessments: Type of categories and usefulness for the prototyping level

SESSION 3: DAY 4 OF THE TRAINING PROGRAMME

Step 4: Business Level – Prototyping – Procedural focus

Learning objective: After completing this step, the participants should be able to plan and build a product prototype

Activities: Create products and experiences for prototyping in groups

Steps: 1. Get feedback from stakeholders, 2. Run learning launches, 3. Design on-ramp.

Tools to use: Continue to finalise prototype, customer co-creation

Assessments: Prototyping idea

SESSION 3: DAY 5 (FINAL DAY) OF THE TRAINING PROGRAMME

Step 5: Professional Level – Test focus
Learning objective: Participants should use customer and manager feedback to improve a prototype and embrace failure after completing this step.
Assessments: Managers' and customers' feedback and final test
Activities: Use feedback to refine and finalise the prototype and design.

There was a break between Session 1 (Days 1 and 2) and Session 2 (Day 3), as per the managers' instructions due to the participants' workloads. Day 3 focused on ideation, creative thinking, and prototyping. The facilitator exposed the participants to the process, steps, and tools and emphasized observation, collaboration, fast learning, visualisation of ideas, creative problem-solving, rapid concept prototyping, and concurrent business analysis. The participants had to familiarise themselves with the design thinking approaches and tools, as well as conduct interviews between various stakeholders to get a feel for their problems and learn to empathise.

6. FINDINGS

The third research objective was to determine whether the customised training programme achieved its overall objective of enabling and equipping the participants to visualise a cost allocation product prototype for further development. Unfortunately, due to time constraints, only two questions could be asked per delegate. Participants' verbatim responses to the interview questions have been provided.

Question 1: Explain how the overall facilitation, training materials, tools, physical environment, and visual aids enhanced your understanding of Design Thinking.

Most of the participants indicated that the facilitator was knowledgeable in design thinking and that the information was presented in a playful and fun-filled manner.

Delegate 10: "On a personal level, I enjoyed the workshop, content, and facilitator's presentation style and approach."

The majority of participants did not believe that the physical environment was adequate.

Delegate 1: "Some meeting rooms were not suitable for brainstorming and ideation."

Delegate 6: "Some meeting rooms used were not conducive for learning."

Most of the participants indicated that the training material was appropriate and that the learning aids improved the transfer of learning. The majority of participants said that the visual aids and examples used during the design thinking programme supported knowledge. They also felt that the video clips and pictures were used effectively.

Most participants complained about the limited time, time constraints, and too many tools used without mastering them properly, especially ideation and prototyping.

Delegate 2: "I think the process of design thinking needs a lot more time and not be concentrated over 3 days, even with a week between Day 1 and Days 2 and 3)."

Delegate 17: "The workshop should be extended to cover all the tools in detail."

Delegate 9: "Allow more time during the different exercises and sessions."

Delegate 19: "In my perspective, design thinking needs a lot of time research on the subject matter and engage a lot of people. What can be improved on it is more time."

Delegate 5: "Extend the time to work through the methodologies."

Question 2: How did the design thinking training programme enabled you and your team to visualise a cost allocation product prototype for further development?

Most of the participants indicated that everyone could use design thinking using selected templates that assisted in developing a product prototype. The participants could produce a cost allocation product prototype but felt that it could have been better if more time was allocated for prototyping and testing.

Participant 3: "Design thinking guides the prototyping process. I think without this tool/template, it would have taken longer to develop a prototype."

Participant 9: I think design thinking is all about developing a prototype suitable for customers and should be tested."

The participants identified that the most useful tools for them to use were brainstorming, value chain analysis, 360 empathy, customer co-creation, mind-mapping, assumption testing, wish cards, and prototyping. Persona cards were cited as the least helpful tool/template for them to use.

Participant 12: "Design thinking requires empathy for the customer, and therefore the tools 360 empathy and customer-co-creation were important to use during the development and final prototype."

The majority of the participants indicated that the knowledge acquired during the training programme could be used immediately and applied in the workplace.

Participant 5: "The training programme provided enough opportunities to explore some of the techniques."

Participant 14: "The training programme was useful, but the time was limited to test the design thinking tools. So I do not feel comfortable using templates yet."

The majority of the participants found design thinking relatively easy to use. Some participants preferred specific templates above others as they worked through the steps and developed the first prototype of a new cost allocation product. Due to time constraints, the participants had to go back to their organisation to finalise their prototype, as feedback was only given on Day 5.

7. RECOMMENDATIONS

Recommendations will be presented according to the three research objectives laid out at the beginning of this paper.

Research Objective 1: Explore design thinking as a pedagogy

Design thinking is a practical pedagogy because it enhances creativity and innovation while assisting educators with curriculum design and guiding students to develop empathy. The actual value of the design thinking pedagogy is that the process is practical and systematic, enhancing self-efficacy in students. However, it is essential to note that design thinking can be confusing initially and is not a readily accessible pedagogy to use.

The first recommendation is that design thinking should be used more widely in training programmes. It will not be easy initially, but exposing a greater number of people to design thinking will generate more creative and innovative solutions. This will show that design thinking is not a wicked pedagogy but rather a novel way of solving wicked problems. Therefore, it is essential to remember that a design thinking pedagogy is not a once-off exercise but one that takes patience and time to master.

The second recommendation is that design thinking should be applied in multidisciplinary environments to add maximum value in terms of ideas and prototypes. Different departments and different levels of employees, for example, should participate together in various sessions. Participants from multiple departments can contribute additional insights based on the differences among departments and their focus areas. A collaborative approach by various departments will enable everyone to see the bigger picture.

The third recommendation is that the various tools and templates for each design thinking process should be critically reviewed before a training programme is developed. Using all of the tools and templates available is likely to confuse people. The training provider thus needs to determine the aim of the training programme and then select the most suitable tool/s for each step.

Research Objective 2: Develop a customised design thinking training programme using the Educational Design Ladder

The Educational Design Ladder is an innovative resource/model that provides a process for organising and structuring units for a multidisciplinary design thinking programme. Therefore, the Educational Design Ladder is a helpful means of developing a curriculum and guiding the design thinking pedagogy. Therefore, the first recommendation is that more facilitators should experiment with the Educational Design Ladder to ensure that students are trained from lower-order thinking to higher-order thinking. The progress through each level/structuring unit should be clear.

The second recommendation is that the Educational Design Ladder should be used as an innovative resource/model with any design thinking pedagogy. The days allocated to training, design thinking steps, SOLO taxonomy, knowledge dimensions, learning objectives, activities, and assessments need to be considered using the Educational Design Ladder. This will help ensure that suitable tools and templates for the specific problems are identified and any areas of concern are highlighted during the planning stage.

Research Objective 3: Enable and equip the participants to visualise a cost allocation product prototype for further problem-solving.

The training programme was scheduled for three sessions over 5 days to develop a suitable cost allocation product prototype. The development of the product prototype was the most important objective of the customised training programme.

The first recommendation for this objective is that more time should be allocated to allow students to experiment with their ideas, especially when drawing, building, and developing their prototypes. The second recommendation is that constant feedback should be part of any design thinking training programme. Waiting to provide feedback could result in mistakes, missed opportunities, inefficient outcomes, problematic prototypes, and money being wasted.

The prototype designers should receive feedback on a more regular basis and not only on the last day. When suggestions are made, the designers should be able to agree or disagree and decide if the prototype meets the needs and requirements. The final approval should come from the designers to ensure buy-in and to make them feel valued.

8. MANAGERIAL IMPLICATIONS

In order to remain sustainable and competitive during 4IR, organisations need employees who possess an appropriate mix of skills and experience. Management teams should therefore have some knowledge about design thinking and not see it as a new fad. However, the recent increased interest in design thinking as an approach to innovation has resulted in its adoption by untrained or inexperienced trainers, professionals, and managers (Wrigley & Straker, 2015). These people often do not realise that design thinking is a complex pedagogy, which takes time to understand, practice, apply, and teach.

The case FSO realised that it did not have the expertise to train the design thinking skills and processes and therefore appointed an external design thinking facilitator. Design thinking is a time-consuming process and cannot be rushed if significant innovations through prototypes are to be produced. This is critical, primarily if it is the first time that design thinking is being used. More time and experimentation with the various tools and templates should ensure that people feel more confident using design thinking over time.

The design thinking training programme used for this paper resulted in the generation of a new cost allocation prototype. The prototype addressed some of the challenges identified by the stakeholders. The problem was that participants only received feedback on the last day, and adjustments at this late stage made some participants unhappy and stressed. Therefore, it is vitally important that participants receive feedback regularly to determine if the prototype will meet the needs and requirements of the stakeholders. When suggestions are made, the participants should agree or disagree, as they developed the prototype. As previously stated, the participant-designers should therefore be the ones giving the final approval.

Design thinking, from a managerial perspective, is a feasible and sustainable strategy. Understanding customers is a crucial competitive advantage. Design thinking makes it possible to focus on the design of products and/or services and related development decisions to meet customers' needs, which are identified in the first step (focus on empathy and employees' ability to "put themselves in their customers' shoes"). Design thinking is human-centred, and collaboration can minimise uncertainty and risk due to its investigation into customer insights for real-world problems from different perspectives. Design thinking also helps break down a complex system into other parts and steps to make it easier to understand and solve any problems associated with it.

From an educational, managerial perspective, the design thinking pedagogy and the Educational Design Ladder can be helpful in the design and development of various educational programmes and serve multiple skills levels. Design thinking also serves as a practical guide for curriculum design and the formulation of training objectives. It develops a growth mindset, the use of imagination, and problem-solving, analytical, and spatial thinking competencies. Design thinking is a valuable skill to have in the future of work and 4IR, as it encourages collaboration and human-centred solutions to wicked problems.

9. AREAS FOR FUTURE RESEARCH

Complex problem-solving, critical thinking, and creativity are among the top 10 skills of the future. Design thinking is a tool to "ignite" and foster these skills. More research, however, is needed into how these skills can be developed and used during design thinking training. Various groups, companies, and universities, for example, can compared to see how the design thinking process is used in these settings and to identify similarities and differences that may arise from various collaborations. In addition, groups can be compared in terms of the templates they select to be utilised and why. The success of ideation and prototyping to eventually lead to developing the best product/service strategy can be identified. The training and implementation of design thinking can be studied and compared across industries and countries, and this might lead to the identification and development of specific templates more suitable for a particular industry, transparent government, particular countries, and different contexts. Future research should also include more participants and cost allocation teams to assist in the design of a prototype such as a new cost allocation product prototype

10. LIMITATIONS OF THE STUDY

A considerable limitation identified by the facilitator and delegates was the time constraints to learn and practice design thinking and to develop the prototype. In terms of the academic study aspect (and not the training programme itself), the fact that time for feedback via interviews was limited may count as a limitation because of the depth of feedback/data that could have been possible with more time. The small sample size from only one department within one FSO make the generalisation of findings not possible. Due to time constraints, the delegates had to go back to the FSO to finalise their prototype, as feedback was only given on the last day and could not be incorporated in the design of the prototype.

11. CONCLUSIONS

Design thinking was highlighted as a 21st-century pedagogy used to seek solutions for wicked real-world problems. As previously mentioned, design thinking is not an easy pedagogy to master at first. It requires time and patience to learn and experiment with the process. This, however, should not be used as an excuse not to utilise it as a pedagogy because design thinking can lead to novel innovation that can solve complex problems. The value lies in the fact that design thinking incorporates in-depth customer insights and rapid prototyping, which are critical for businesses.

This paper explored the design thinking pedagogy and Educational Design Ladder to enable the employees of an FSO to create a cost allocation product prototype. The research question was answered, and three research objectives were achieved in this paper. The Educational Design Ladder assisted in planning how design thinking training would take place over 5 days and helped develop the learning objectives, activities, assessments, steps, tools, and research.

The customised training programme was successful and met most of the requirements of the participants and organisational management. It was evident that the FSO had not used design thinking before and that 5 days (the length of the training programme in this case) was not enough to master design thinking and deliver a reliable prototype to be further adapted to the business's needs.

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