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DESIGN THINKING INTERVENTION IN HEALTHCARE

ALSHEHRI, MOHAMMED ALI M

SINGAPORE MANAGEMENT UNIVERSITY

2020

Design Thinking Intervention in Healthcare

Alshehri, Mohammed Ali M

Submitted to Lee Kong Chian School of Business in partial fulfilment of the requirements for the Degree of Doctor of Innovation

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2020
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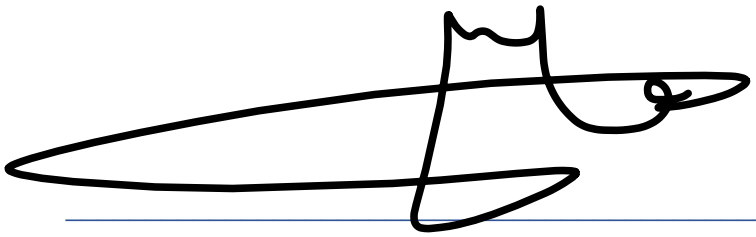
I hereby declare that this Doctorate dissertation is my original work and it has been written by me in its entirety.

I have duly acknowledged all the sources of information which have been used in this dissertation.

This dissertation has also not been submitted for any degree in any university previously.



Alshehri, Mohammed Ali M

8 June 2020

Design Thinking Intervention in Healthcare

Alshehri, Mohammed Ali M

Abstract

The healthcare industry is currently experiencing numerous challenges. Lack of skilled and innovative practitioners in healthcare organizations disrupts operational functions, administration, and service delivery. Dentistry is full of complex problems. There is currently a significant gap between the desired solutions dental providers offer to solve these problems and the actual outcomes. So, dental providers must rethink their approach to solving healthcare problems. One of the desirable approaches is design thinking.

Application of design thinking in business and healthcare has demonstrated improved results. In this research, the objective was to investigate the application of design thinking in dentistry and its effects on patient experiences from staff and patient perspectives. Through design thinking, dental practitioners can develop new solutions to address the existing problems patients normally face, thus improving patient experiences.

The research adopted a mixed method consisting of semi-structured interviews and surveys as well as an intervention. A design thinking workshop was carried out as an intervention to test the responses of the participants before and after the intervention. The workshop was administered in seven sessions. Staff responses were evaluated before and after the training sessions. Moreover, three days of training were conducted to educate the participants on using scripts and checklists in the workplace. The participant targeted in this research comprised of the staff and patients. The staff included dentists, dental assistants,

receptionists, and administrators. The primary data collection tools included survey questionnaires and one-on-one semi-structured interview sessions. The main ethical issues for consideration are privacy, confidentiality, and informed consent.

Design thinking was applied to solve complex dentistry problems, improve the outcomes for the staff, and improve patient experiences. The staff re-examined their dental practices and came up with new ways to handle dentistry problems and improve patient experiences. The findings indicated that there is no significant impact of design thinking methodology on empathy, and there is a significant impact of design thinking methodology on the other variables. We accepted the hypotheses that have a significant difference to improve the patient experience by design thinking intervention as well as staff attributes, physical facilities, and dentist initiative significantly increase patient satisfaction by design thinking intervention. Moreover, there were changes in staff responses before and after the workshop training sessions.

The study is significant in providing insights into dental care practice improvements and advances the literature on design thinking and patient improvement in dental clinics.

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Acknowledgement

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Chapter 1 Introduction

Background of the Study

The healthcare industry currently experiences numerous challenges (Shaikh et al., 2018; DeWolf, 2009; Barry & Edgman-Levitan, 2012). In Saudi Arabia, dentistry integrates business with healthcare services. Most of the patients usually pay money to get treatment for dental procedures including dental radiographs, fluoride applications, dentures, dental fillings and crowns (Sbaraini, Carter, Evans & Blinkhorn, 2012). Alaghemandan, Yarmohammadian, Khorasani and Rezaee (2014) give evidence indicating that patients usually question the attitudes and behaviours of the dentists during dental visits in which practitioners perform highly technical problems. Nonetheless, there is little knowledge known regarding the experiences of patients in dental clinics as a whole.

There has been a tendency towards a patient-focused treatment following the improvements in healthcare internationally. The findings by Barry and Edgman-Levitan (2012) illustrate the changes in healthcare. Accordingly, the focus has progressively changed from treating illnesses to providing care with more understanding of the patient's preferences, values and needs, thereby guaranteeing safety and quality. In addition, Shaikh et al. (2018) show how it is very challenging to put new ideas and words into practice to adopt structures which enhance patient participation in treatment options and decision making. In this regard, Porter & Lee (2013) call upon more investigations into alternative methods to enhance innovation in healthcare, thus improving service delivery.

According to Sbaraini, Carter, Evans and Blinkhorn (2012), scholars have conceptualized patient satisfaction as a concept which is measured through

standardized quantitative instruments. Often, researchers modify these instruments for application in specific topic areas (DeWolf, 2009). Systematic reviews and primary research, in this regard, have been conducted to investigate patient satisfaction levels with specified kinds of therapy (Lin et al., 2011). In dentistry, for instance, researchers have used questionnaire surveys to assess patients' nervousness before treatment, service delivery aspects (e.g. service facilities, dentists' technical ability and treatment costs) and their dislikes during dentistry treatment as well as their opinion.

Research in the medical literature has suggested a correlation between patient experience and general care components shared across various clinical settings, subsuming dentist competency, knowledge and shared decision making (Roberts, Fisher, Trowbridge & Bent, 2016). Moreover, quantitative and qualitative investigations give a general outlook in efforts to understand various experiences of patients with care delivered. Evidence demonstrates that the actions and attributes of healthcare staff and service providers, in addition to their how they associate with patients, largely impact patient experiences (Shaikh et al., 2018; DeWolf, 2009).

To improve service delivery and patient outcomes in healthcare, Alaghemandan, Yarmohammadian, Khorasani and Rezaee (2014) suggest that there is a need to get feedback regarding patient satisfaction from the dental care offered. Healthcare providers need to address patient attentiveness. This calls for understanding factors that influence patient satisfaction with dental services. Research by Criscitelli and Goodwin (2017) showed that patient-personnel interaction, system efficiency, technical competency and the clinic environment influence the level of patients' experience with dental healthcare services.

In healthcare service delivery, Lamé, Yannou and Cluzel (2018) point out the importance of innovation. Practitioners need to design innovation, which answers the unmet needs in healthcare. The reason for this argument is that healthcare professionals are not adequately prepared for stages such as problem formulation, solution design and legal requirements (Lin et al., 2011). Most innovative ideas concentrate on improving technical products and service delivery (Seidel & Fixson, 2013). So, innovation is vital in the healthcare industry design processes which have a weak design approach. In these innovative ideas, scholars have proposed strategies including design thinking, Blue Ocean and TRIZ.

Health systems are required to develop a stronger capability to align current and future healthcare services given the growing and unprecedented social, political and financial pressures (Roberts, Fisher, Trowbridge & Bent, 2016). For healthcare systems to operate successfully, they must be innovative and deliver services which cut across geographical, sectoral, political and organizational boundaries (Seidel & Fixson, 2013). Such concepts are evidently not new. Yet, the easily accessible practice models for combining daily operations in healthcare to increase efficiency remain limited.

According to the argument presented by Roberts, Fisher, Trowbridge and Bent (2016), design thinking is an innovative model that is progressively being used in healthcare and business sectors. The model can provide professionals in healthcare a recognizable and well-defined practice model for combining interdisciplinary, human-centred and creative approaches to the healthcare practice and management (Uehira & Kay, 2009; Lin et al., 2011; Seidel & Fixson, 2013).

Current markets are changing towards integrated services and products. This trend has encouraged a substantial shift in the way firms to train their workers, invest in innovative practices and engage with clients (Lin et al., 2011). One of the most noticeable successful tendency is a widespread investment in the design thinking framework (Bernstein, 2015). This innovative framework prioritizes empathy for service users, includes highly collaborative and diverse project teams as well as spurs action-oriented rapid prototyping (Roberts, Fisher, Trowbridge & Bent, 2016). As such, more research into the potential offered to healthcare management through design thinking is worth pursuing.

Research in design thinking has shown that various patient activities usually improve due to a design thinking approach (Lamé, Yannou & Cluzel, 2018). They include staff and healthcare service provider flow and collaboration, patient adherence to treatments, scheduling of patient appointments, patient satisfaction scores, patient flow during clinic visits and procedures, reducing waiting time, communication with the patients regarding their outcomes and clinical/office space usage (Uehira & Kay, 2009; Lin et al., 2011; Bernstein, 2015; Seidel & Fixson, 2013).

The literature on the dentist and patient association gives some clear suggestions about the perceptions and expectations when visiting dental clinics (Sbaraini, Carter, Evans & Blinkhorn, 2012). Overall, the findings have been linked to dentists' technical competency, their attitudes and behaviour as well as communication and collaboration skills (Uehira & Kay, 2009). Generally, patients want dentists who can listen to them, explain treatment procedures and options, inspire confidence and have friendly/caring attitudes (Shaikh et al., 2017). This outcome corroborates the medical literature findings arguing that

the quality of the relation physicians has with patients affect patient experience levels.

Through design thinking, dental practitioners can develop new solutions to address the existing problems patients normally face, thus improving patient experiences. Erbeldinger, Ramge and Erbeldinger (2013) research described design thinking as radical, user-orientation, based on interdisciplinary principle. In the same context, Curedale (2013) described design thinking as a people-centred method for solving challenging problems. The approach adopts a team-based and collaborative process. The methods used can be adopted in any setting. Overall, the approach integrates goal setting, process, orientation and various participants.

Various findings have shown that design thinking has a positive impact on patient experience (Seidel & Fixson, 2013; Bernstein, 2015; Lin et al., 2011; Cheung, 2012). After undergoing design thinking, this study seeks to establish if there are improvements in outcomes, including provider and staff collaboration, care coordination, proficiency and work practices. The improvement, or lack of, can give insights into patients' experiences with dental healthcare practices and their satisfaction levels.

The concept of design thinking as applied in dental healthcare is insufficiently studied (Criscitelli & Goodwin, 2017). Most of the research is qualitative. While medical practitioners seem excited about the benefits of design thinking, there is confusion regarding the exact definition and components of design thinking and how it looks in dental healthcare (Shaikh et al., 2017). In design thinking, a major philosophy is embracing change.

Nonetheless, few investigations have explored the practices of dental care service delivery after design thinking intervention.

Research Problem

Lack of skilled and innovative practitioners in healthcare organizations disrupts operational functions, administration and service delivery (Roberts, Fisher, Trowbridge & Bent, 2016). From the business viewpoint, losing patients due to poor service delivery is costly, and damages the reputation of healthcare service providers (Cheung, 2012). The general problem is that patients leave healthcare facilities that do not provide proper care, within the recommended time, in efforts to seek for better services. Some healthcare providers do not correctly understand the association between patient perceptions of their staffs' characteristics and patients' level of satisfaction with services rendered.

The dental literature clearly demonstrates that patients have various expectations from the dentists, including support and care, dedicated and committed dental teams, education on preventive dental care and information regarding alternative treatment options (Sbaraini, Carter, Evans & Blinkhorn, 2012; Criscitelli & Goodwin, 2017). However, there is no clear illustration of how patients usually experience various treatment approaches in dental care before and after the staff has undergone some interventions, including design thinking. The literature on this topic is very scarce. This literature gap makes it vital to investigate and report the experiences of patients with dental care, specifically on the correlation between the general dental staff and patients.

In dental care, patients value various treatment components (Sbaraini, Carter, Evans & Blinkhorn, 2012). Design thinking approach evidently has

some implications on such values. This research is about the impacts of applying design thinking methodology in the healthcare setting, with a primary focus on dental clinics. The gap in scientific knowledge that the proposed study aims to address is the impact of design thinking. No study has examined the impact of design thinking on patient experience in dental clinics in Saudi Arabia context. Therefore, this study addressed this gap.

Aims and Objectives

The aim of this study is to investigate the impact of design thinking on patient experience in dental clinics. The following are the main specific objectives:

i. To determine the difference of patients' perception toward a) staff's attributes, b) dentist initiative, c) physical facilities and d) overall patient experience levels before and after the intervention.

ii. To determine the difference in staff's Skills in solving the problem, team dynamics, behaviour, Challenging, Psychological ownership, empathy, Perspective-taking and creative confidence before and after the intervention.

iii. To explore the impact of design thinking and routinization on the staff's perspective.

iv. To identify the impact of design thinking on patient experience in dental clinics.

Motivation for the Study

From the organizational theory perspective, there is a need for healthcare organizations to introduce changes that will inform how team members work together to solve different problems using design thinking tools and techniques. The dental profession is experiencing changes in necessitating innovation and

improvements. Today, patients are highly diverse, demanding for numerous services. As such, dental practices need change. This study seeks to examine the impact of design thinking intervention on patient experiences.

In the healthcare industry, organizations seek to maximize profitability by improving service delivery. Thus, they have to recruit and retain skilled employees who offer quality services to patients to increase referrals. The research is significant because it provides value to business operations and has a social impact. The study is beneficial to the healthcare industry, thus giving a contribution to effective healthcare practices. In other words, the study has some contribution to positive social change and improvement of key practitioners in the industry. It provides valuable information, which helps healthcare practitioners gather information about dental care practice improvements.

The study has research contributions as it studies advances the literature on design thinking and patient improvement in dental clinics. In advances the literature on how design thinking supports health care organizations in addressing dental care problems to improve the patient experience. A substantial predictive framework can support leaders and researchers predict patient turnover intentions and adopt interventions which help increase the number of patients accessing treatment services in dental clinics.

Purpose of the Study

The purpose of this mixed-method research study is to investigate the impact of design thinking on patient experiences in dental clinics. Thus, it examines the relationship between patients' perceptions of the staffs' characteristics and patient satisfaction level: the study targets patients and the dental staff located in Saudi Arabia.

This research examines the application of design thinking methodology in dental clinics and its impact on patient experience in Saudi Arabia. By using design thinking technique, the problems and needs of patients are identified. The research demonstrates the results of a mixed research study undertaken in Saudi Arabia's general dental practice. The primary focus is on the experiences of patients in dental care, before and after the staff has undergone design thinking approach training/workshop.

Research Questions and Hypotheses

Research Questions

In this research, the problem under investigation is what is the impact of design thinking on patient experience in dental clinics in Saudi Arabia? The purpose of the research was to investigate the impact of design thinking on patient experience in dental clinics. The following research questions guide this research:

i. Can design thinking intervention improve patient experience?
ii. Can design thinking intervention improve patients' perception toward a) staff's attributes; b) dentist initiative; and c) physical facilities?
iii. Can design thinking intervention improve the staff skills of solving the problem, team dynamics, behaviour, Challenging, Psychological ownership, empathy, Perspective-taking and creative confidence of the staff?
iv. Can design thinking methodology and routinization improve staff perspective?

Hypotheses

The following hypotheses guide this study:

H1: There is a significant difference in the mean score of staff's Skills in solving the problem before and after the intervention

H2: There is a significant difference in the mean score of staff's behaviour before and after the intervention

H3: There is a significant difference in the mean score of staff's team dynamics before and after the intervention

H4: There is a significant difference in the mean score of staff's ability to handle challenges before and after the intervention

H5: There is a significant difference in the mean score of staff's empathy before and after the intervention

H6: There is a significant difference in the mean score of staff's perspective-taking of patients before and after the intervention

H7: There is a significant difference in the mean score of staff's psychological ownership for work before and after the intervention

H8: There is a significant difference in the mean score of staff's creative confidence before and after the intervention

H9: There is a significant difference in the mean score of staff's attributes before and after the intervention

H10: There is a significant difference in the mean score of dentists' initiative before and after the intervention

H11: There is a significant difference in the mean score of Physical facilities before and after the intervention

H12: There is a significant difference in the mean score of patient experience before and after the intervention

Conceptual framework

The conceptual framework from the scholarly literature that grounds the study considers patients and staff attributes. Patients define their experience levels considering their visits to dental clinics, Staff Attributes in communication(Gürdal et al., 2000; Bahadori et al., 2015) , the respect shown (Gürdal et al. 2000; Bahadori et al., 2015), explanations given(Gürdal et al. 2000), involvement in treatment (Mandokhail et al., 2007)., cost {Bahadori et al., 2015); and waiting time (Kashbour, 2016; Singh, Sheth, Burrows, Rosen, 2016; Aeenparast, Tabibi, Shahanaghi & Aryanejhad, 2013; Namana & Al-Dori, 2018). An increase or reduction in dentist initiative (Narayanan & Greco, 2014; Larsson & Bergström, 2005; Bahadori et al., 2015; Kashbour, 2016; Luo & Wong, 2018; Inglehart et al., 2016; Namana & Al-Dori, 2018; Larsson & Bergström, 2005; Mandokhail et al., 2007; Luo & Wong, 2018); and physical facilities (Bahadori et al., 2015; Narayanan & Greco, 2014; Kashbour, 2016; Namana & Al-Dori, 2018; Aeenparast et al. 2013; Mandokhail et al., 2007) all these influence patients' experience level. See Figure 1.

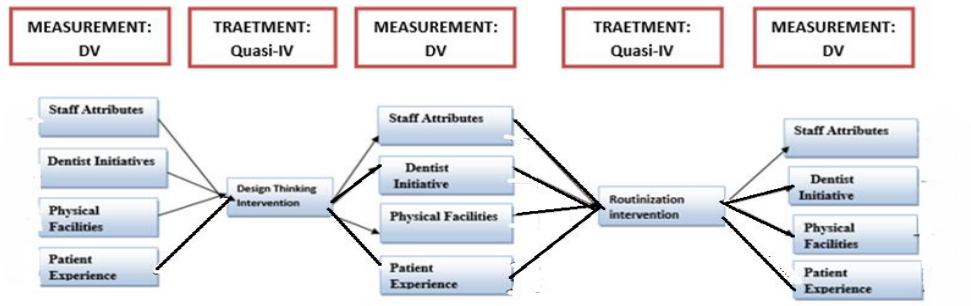


Figure 1: Examining the Effect of Intervention

In the healthcare sector, design thinking helps guarantee patient-focused practices (Chanpuypetch & Kritchanchai, 2017). Some of the main

determinants of these practices include team effort, empathy, behaviour and attitudes among the staff (Narayanan & Greco, 2014). To determine whether design thinking methodology and routinization have an impact on skills of solving problem (Blizzard et al., 2015; Chesson, D. 2017); Behaviour (Marks, 2017); Team dynamics (Lund, 2014); Challenging (Lund, 2014); Psychological ownership (Avey, Avolio, Crossley, & Luthans, (2009); Empathy (Davis,1980); Perspective taking; (Grant & Berry 2011); creative confidence (Royalty, Oishi & Roth, 2014); we investigated. See Figure 2.

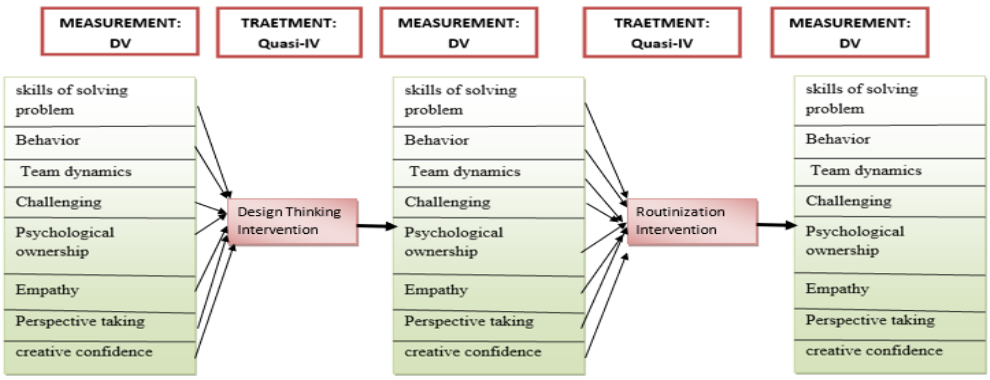


Figure 2: Examining the effect of the interventions on the dental staff

Chapter 2 presents a review of current research relevant to the problem and the research questions that were investigated. Chapter 3 describes the methodology, research design, and procedures for this investigation.

Chapter 2 Literature Review

Design Thinking in General

Many successful organizations use the design approach as instruction for solving problems (Yeager et al., 2016). Scholars, in this context, have established the contribution of design thinking in business (Valentine et al., 2017; Sirendi & Taveter, 2016). The key contributions are in innovation,

namely new service development and new product development (Matthews & Wrigley, 2011). The method is sensible, useful for solving problems irrespective of their nature. Recently, the design thinking method had become a significant component in company strategy, other than being part of the process and product design (Bucolo & Matthews, 2010).

In business literature, scholars have used case studies and user stories involving top managers to popularize design thinking concepts (Seidel & Fixson, 2013; Brown & Wyatt, 2010). Frog design and Design Continuum, for example, have been primarily applied in the development of new products for many years (Matthews & Wrigley, 2011). Design thinking, in this context, is understood as a human-centred approach towards innovation (Yeager et al., 2016). The innovation involves getting inspiration from people, prototyping, using stories, having an inspiring culture and building to think (Brown & Wyatt, 2010).

Nature of Design Thinking

Design thinking focuses on problem-solving. Designers seek results which are viable for customers, feasible within the design and technical constraints and desirable for users. So, problem-solving situations call for the application of design thinking. According to Gasparini (2015), design thinking combines user understanding, user needs, abductive reasoning and rapid prototyping to find the best potential solution to a problem.

Design thinking approach is generative in nature with respect to developing new solutions (Matthews & Wrigley, 2011). As such, the method is applied beyond the business environment. For instance, design thinking has been applied in social enterprise and social innovation (Selloni & Corubolo,

2017). In the discussion by Brown & Wyatt (2010), design thinking clearly leads to numerous ideas and real-world solutions which create improved outcomes for people serving different organizations, and organizations themselves.

According to Cooper, Junginger & Lockwood (2010), integrative thinking involves applying design thinking in business transformation and business strategy. The method focuses on business transformation, innovation, identification of unmet opportunities and needs and the establishment of new visions as well as alternative scenarios. In design thinking, the main component is the capacity to acquire new knowledge; practitioners are likely to apply different tools and methods (Bucolo & Matthews 2010).

General Design Thinking Interventions

Ward, Runcie & Morris (2009) outlined the methods utilized to integrate design capabilities in small businesses for innovation by the UK Design Council. The authors examined Design Council programmes, and case studies, processes and tools included in design-led innovations. The paper found programs that use design thinking, co-creation and design mentoring to enable firms to create innovation capacity. The findings were explained in five themes, namely brand and identity, vision and strategy, user experience, innovative culture and product and service.

Carroll et al. (2010) carried out the design thinking process using a six-step model. Students were key participants in this study. They were instructed to follow the whole process and suggest conceptual solutions. Experts commented that some solutions were useful in addressing design thinking problems. The conceptual designs, nonetheless, require the addition of other

factors, including trial manufacturing, user testing, business marketing and material costing (Yang & Man, 2018).

Melles, Howard & Thompson-Whiteside (2012) describes the process followed by Swinburne University to develop a design thinking course used for teaching in Hong Kong and Melbourne. A pilot study was first carried out in one semester in 2011 before enrolling 90 students from the two countries. The researchers held a moderation meeting in which they discussed with students the teaching process, student outcomes and experiences. The teaching aspect included 2-hour tutorial and one hour lecture each week. The authors describe the key lessons learnt and considerations in future design courses.

Pavie & Carthy (2015) present the outcomes of research that examined the deployment of the design thinking method in developing responsible innovations considering the responses from the financial industry in France. The study presents the process followed in developing innovative products and services. The authors used four workshops for the participants to process, debate and exchange information regarding design thinking and innovation. The first workshop focused on the formulation of concerns being treated, the second one on new desirable service concepts, the third one on concept analysis and refinement and the last one on testing the three concepts chosen.

Volkova & J¯akobsone (2016) analyzed the awareness and the use of design thinking using a sample from Latvia. The study outlined how design thinking management tools and methods help create new organizational capabilities while sustaining competitiveness. A survey questionnaire with 19 questions was employed in data collection. The responses were gathered from

374 respondents randomly chosen from some companies in Latvia. An analysis of the macro and micro factors that influence the entire innovation ecosystem revealed that business managers use cost reduction methods and lack awareness about design methods for renewed business models, product development and enhanced business processes.

Related literature

Design Thinking in Healthcare

In healthcare, several studies indicate that design thinking focusing on service design is in early stages with most organizations adopting an interdisciplinary approach (Lee, 2017). Researchers have thus collected and described various service design thinking tools and techniques (Shaikh et al., 2017). In each investigation, practitioners recommend different methods to classify various service design toolkits. Liedtka and Ogilvie (2011), for instance, group design thinking into four stages. The questions asked at each stage are: what if? What is? What works? What woos? Ten tools applicable to the four stages are also suggested.

Through design thinking, organizations adopt innovative ideas by understanding the needs of different customers so that they can meet these needs and introduce new products/services to obtain competitive advantage (Lee, 2017; Shaikh et al., 2017). In healthcare, design thinking is applied, specifically in digital assets, information technology, hospital environment, patient experiences with products and services and medical devices domains (Andreassen et al., 2016). Through the prevention of diseases and their effects, and care service delivery, the healthcare system directly influences the

community (Bae, Lee & Kim, 2014). With complexities in healthcare, organizations are required to design very effective care services.

According to Lee (2017), well-designed and planned healthcare service processes take into account the providers' and patients' experience, at the same time paying attention to patient activities. The two areas contribute to value creation. Organizations, thus, must create strategies which guarantee positive patient experience; the strategies focus on providers' design to create more value (Bae, Lee & Kim, 2014). Such approaches entail manipulation of service design processes, management of the interplay across the patients and possible client activities and adoption of designed services (Andreassen et al., 2016). In this regard, Lee (2017) developed a design thinking framework showing the way patient participation enhances value co-creation through service interactions.

Researchers have proposed models that use patient experiences to design healthcare services (Lee, 2017). The design process includes specific resources, namely medical technology, social media, the healthcare provider and patients. Any service encounter comprises of the preprocessing process, response and the outcomes (Andreassen et al., 2016). Healthcare organizations have indirect and direct associations with the administrative and medical personnel, who ultimately relate with patients (Bae, Lee & Kim, 2014). After providing care services, the patients determine the relationship with practitioners based on care service outcomes. A study by Lee (2017) demonstrates the significance of improving patient satisfaction through care service design when practitioners adopt design thinking approach.

Lee (2017) proposed a framework for the service design process in healthcare useful in value co-creation. In this model, healthcare institutions are required to create new opportunities to enhance patient value. According to Bae, Lee & Kim (2014), using medical information systems and technologies to connect all data within the healthcare system increases flexibility, improves care quality and enhances the positive interplay between patients and their relatives. Patient participation is vital in design thinking, as the healthcare organizations commit to providing a safe environment characterized by convenience, accuracy, ease, simplicity, kindness and protection of personal information (Lee, 2017).

Design thinking is described as an innovative approach in healthcare (Bae, Lee & Kim, 2014). Multidisciplinary teams apply design methods to numerous innovation problems (Chasanidou, Gasparini & Lee, 2015; Shaikh et al., 2017). Seidel and Fixson (2013) investigated the adoption and use of design thinking within multidisciplinary teams, considering novice users. The findings suggested that less experienced users employ design methods. The implications of their research are that less experienced, and multidisciplinary teams succeed in adopting design thinking if they receive guidance on integrating the methods, use less reflective practices and know the restrictions of brainstorming.

During the design thinking process, firms use multidisciplinary teams as a means to increase the performance of their teams (Seidel & Fixson, 2013). For organizations which depend heavily on multidisciplinary teams, the main strategic concern is to understand how to manage innovation. The implementation of multiple design viewpoints, in turn, is projected to increase performance with respect to innovativeness in problem-solving and quality

decision making (Chasanidou, Gasparini & Lee, 2015). Considering the innovation process, Selloni & Corubolo (2017) found that brainstorming models mean that group creativity benefits from multidisciplinary. The team has a broad range of abilities, abilities, ideas and knowledge.

Bae, Lee and Kim (2014) study used healthcare case studies to examine the relationship between service design methods and tools and service orientation. General hospitals and clinics were considered in this investigation. The authors considered methods and tools such as ethnography, shadowing, questionnaire, co-creation, brainstorming and observation. The intervention focused on major areas, including heuristic evaluation, task analysis, usability test, project prototyping and customer journey map. The findings show that using suitable service design methods and tools improve the performance of medical and health services (Bae, Lee & Kim, 2014).

Design Thinking Interventions

Designers have created ergonomically designed backpacks in efforts to avert injuries in children. Such a design was demonstrated by Amiri, Dezfooli & Mortezaei (2012) where the researchers used design thinking to design and redesign a backpack made to reduce the amount of distress students would feel. Participants included school-going children aged 7 to 9 years from Iran. The methodology in the study included focus groups, ethnography (interviews and observation), prototyping, hidden filming and brainstorming. The health outcomes measured were postural dysfunction, musculoskeletal pain and disorders. The authors tested their backpack on a sample of of120 students. Their data disclosed that their backpack reduced the effective loads on the children's neck, shoulders, waist and back.

In a clinical trial, Catalani et al. (2014) assessed the effect of tuberculosis (TB) decision support system (DSS) by adopting a human-centred design (HCD). The participants included individuals affected by HIV and TB, individuals who care for these patients and staff from the care organization. To understand the condition by collecting and analysing primary data, create a new DSS and adopt it across various clinics, the authors used human-centred design. The approach included key informant interviews, site observations, in-context usability testing and lab simulation. The results reported showed that HCD enabled digital innovation, improved the understanding of providers' assets and needs as well as develop a TB DSS to improve the findings in intensive care unit.

Summary

Design Thinking Studies

Source	Intervention components	Design thinking process/	Method	Results
Šadeikaite (2017)	Design thinking was investigated in relation to innovation uptake, skills and attitudes of students, relevance of education for practice and demographic characteristics.	The design thinking process included 4 phases, abduction (general ideas), deduction (prediction of consequences), testing and generalization. The author considered the design school main elements, empathize, define, ideate, prototype and test.	Quantitative method: multiple regression, ANOVA, t-tests and factor analysis.	Design thinking positively impact student skills and knowledge. Moreover, design thinking positively influence business education for practice and innovation uptake.
Souza and Silva (2015)	The researchers designed a mobile prototype	To create the mobile learning environment, the	Mixed method including	The mobile learning environment

	and carried out an experiment with students and teachers to confirm its applicability. Experimental and control groups were used for comparison purposes. 13 users finally evaluated the solutions that were generated by the prototype.	design thinking process followed 3 main stages, namely immersion, ideation and prototyping.	interviews and questionnaire.	prototype implemented improves learning as well as teaching processes.
Ulibarri et al (2014)	The researchers conducted 13 workshops for 3 years with students, administrative staff, research staff and faculty members. Data collected was sourced from in-class observations and experiences, workshop materials, curriculum, debrief, reflection and survey. The researchers also administered a follow-up survey.	The design thinking process comprised of 5 stages, namely empathize, define problem, ideate, prototype and test.	Mixed method, n=240	The workshops helped the participants become more creative, confident and productive. The workshop atmosphere was emotionally empowering. Additionally, the students revealed that design mindsets were useful and refreshing.
Santos, Neto, Neto & Filho (2014)	Appling design thinking method in the hospital's hemodialysis unit.	The design thinking process comprised of 4 phases, immersion, ideation prototyping and completion. The three stages took	Qualitative method	Eventually, the team created an intervention proposal which supports patient education and adaptation with regards to diet. The results did

		63 days, 10 days and 14 days and 14 days respectively. In immersion, the team sought to understand healthcare problems. During ideation, the team sought to creative innovative and original ideas. During prototyping, the team sought to validate the ideas created during ideation.		not fully prove that design thinking led to innovation and improvement in patient experiences.
Blizzard et al (2015)	The researchers developed and tested survey questions purposed to identify various design thinking traits among college students.	The researchers mapped 9 questions into 5 key design thinking characteristics including collaboration, optimism, experimentalism, integrative thinking and feedback seeking behavior.	Quantitative method, n= 6772	The analyses performed showed that design thinking characteristics were positively correlated with the desire to address various sustainability responsibilities, desire to help others or solve societal problems and higher achievement
Patel, Moore, Blayney & Milstein (2014)	The sampled population comprised of individuals from health care delivery systems, adult patients, healthcare providers and payer groups with experience in cancer care.	The intervention was applying design thinking methods in cancer care delivery	Quantitative method using convenience sampling.	Trans-disciplinary approaches that involve using design-thinking help improve value when delivering cancer care.

Yin, Siew, Ng, Putra & Ang (2016)	The researchers searched for a proof of concept using design thinking methods and human factors. The researchers carried out 10 2-hr observations for one month.	The researchers design a prototype that can improve storage capability. Tray tables were attached to trolley beds so as to improve the storage capacity in the hospital.	Quantitative study. The survey targeted 10 doctors, 2 transporters and 38 nurses.	The following were given as major requirements for redesigning tray table attachments: Blood sample bottles, clipboard, Vital signs monitor, IV kit tray, Hypocount meter, hand sanitizer, team tag and Cordless phone.
Wolstenholme, Downes, Leaver, Partridge & Langley (2014)	Design thinking focused on a creative mindset. This included prototyping, verbal communication, lateral thinking and visual communication.	To illustrate several parts of design thinking process, the authors used 4 workshops. The participants spend time with design teams engaging in various group activities. After each workshop, the participants filled the appraisals of disability scores (ADAPSS) and Perceived Manageability Scale (PMnac) scores.	Quantitative study, n=20	The results showed significant improvements in EuroQol-5D (EQ-5D) score and Patient Activation Measure (PAM) score.
Shine (2012) report	33 patients were recruited, 20 data sets examined, and 140 workshops run for 8 months. Quantitative data was measured using perceived manageability of condition, EQ-	In each workshop, the patients filled PMnac and ADAPSS. The operational parameters considered were length of stay and readmission rates.	Mixed method evaluation, n=33.	140 sessions were completed with the patients as participants.

	5D, PAM and ADAPSS.			
Thies (2015)	Various participants were observed in the Swedish hospital, including patients, doctors, nurses and nurse assistants. Observations done for 35 days at the Primary Care Unit (PCU). 40 staff members were observed on several occasions for 1-2 hours. The study took 15 months.	Human computer interaction that seek to improve patient booking.	Mixed method	Design thinking helps avoid deceptive problems. It improves the procedure of patients booking appointments.
Ying, Yinman, & Renke (2015)	The focus of the research is on ideation during service design. The service ideation process considering team-based design activities. The focus was on group collaboration, taking into account to major groups. 18 designers participated in the study. The participants took 2 hours to complete design tasks and finally answered screening questionnaire.	The authors used Dorst proposition framework and reflective practice theory, emphasizing on two main issues. The first issue was analysis (naming, moving and lastly reflecting). The second emphasis was design (analysis, comparison of the trigger impact in the teams).	Mixed method, data was collected using Verbal protocol experiment.	The findings give guidelines of training novice thinking. The team, having participated in creative design activities, achieved high quality outcomes.
van de Grift and Kroeze (2016)	Multidisciplinary task training for students working	The design thinking process comprised of 3	Mixed method (qualitative	The collaborative approach to

	in teams. The team members were sourced from medicine, art, neuroscience, social sciences and psychology. On-site facilitators monitored the students as they interacted with their colleagues and the patients. The instructors then judged students considering interdisciplinary origin and patient centeredness	key stages. The stages were inspiration, ideation and implementation taking 8 weeks, 5 weeks and 2 weeks respectively. Using this process, the researchers structured a Hacking Healthcare course to be undertaken by students during the 2014 fall period.	interviews and quantitative survey)	healthcare revealed various tangible outcomes pertinent to patients. The results include helping patients with dementia cope with their losses through workshops, reduction in attention problems (using instruction manual), improved casual contact, improved obesity prevention and empowered surgery room preparation.
Seeber et al (2015)	The Vienna Vaccine Safety Initiative (ViVI) focused on various design thinking principles. The process involved steps such as understand, observe, generate some points of view, ideate, prototype and test. Students were grouped into small multi-disciplinary teams.	A 2-week Design Thinking project (advanced track) devoted to enabling the dialogue between physicians and parents about the prevention of various infectious diseases.	Mixed method	Through design thinking steps, parents and children were able to prevent various infectious diseases
Uehira and Kay (2009)	The study included two phases, expert interviewing and user	A workshop was carried out with patients to identify key topics and	Qualitative study	Design thinking improves overall patient experience. The practices spurs

	observations in the hospital setting. The researchers identified various patient experiences and created personas for each experience. 11 product ideas were used to create one prototype.	themes related to design thinking. It was followed by user observations in Japanese hospitals		production development and improved innovation.
Pottenger et al (2016)	The study sought to investigate whether or not healthcare organizations could use Comprehensive Unit-based Safety Program (CUSP) teams to improve patient experiences. CUSP teams participated in design thinking activities, including performance tools encompassing peer-learning communities and data analytics. The teams completed a sprint challenge exercise that included weekly meetings, progress trackers and department leader meetings conducted monthly. The Hospital Consumer	The main intervention was system process change. The intention was to improve the way patients perceive discharge processes and care transitions.	Quantitative research. 22 teams comprising of providers were sampled.	Improvements were reported regarding patient ratings of discharge information (76.0% pre-intervention to 84.5% post-intervention) as well as care transition ratings (49.2% to 53.6%).

	Assessment of Healthcare Providers and Systems (HCAHPS) was used as a survey to measure discharge information, care transitions and overall hospital ratings.			
Raghu, Praveen, Peiris, Tarassenko and Clifford (2015)	The authors created a clinical decision support tool which evaluates and manages cardiovascular disease risks in settings where resources are limited. The researchers conducted pilot testing to obtain the feedback on preliminary acceptability, efficiency and utility of the developed tool.	The intervention was a Mobile health Tool. The analytics model used investigated 4 key areas, namely end-user variability, system efficiency, point-of-care management recommendations to healthcare workers and errors originating from manual data entry exercise.	Quantitative research, n=292 patients and n=14 healthcare providers.	Using the mobile health tool, the researchers successfully measured the risk profile of the users and referred the patients to higher care levels.
Kuipers et al (2016)	The scholars tested the game as a support system for behavior change. Using a design research science method, the authors created a playable prototype.	In iLift project, the scholars developed for use by the nursing personnel. The nurses received training on lifting and transfer methods.	Mixed method including field experiments. N=37	Increase in play predicted increase in game scores. The players, after the training, exhibited correct methods for lifting and transferring thus preventing lower back problems.
Adirim, Chafranskaia and Nyhof-Young (2012)	All groups involved in the study read pamphlets that sought to increase	The intervention modality comprised of educational pamphlet. The goal of the	Mixed study, N=45. Pre-intervention and pro-intervention study designs	Successful outcomes of design thinking were reported. Perceived knowledge was

	awareness of breast cancer. Breast cancer survivors completed two questionnaires which enquired about demographic characteristics, satisfaction and pamphlet evaluation. The study sought to correlate pamphlet effectiveness with education and income level.	pamphlets was to help realize and maintain bone health among cancer survivors. Expert consultation formed the basis of the design thinking intervention.	were employed.	found to increase for high-income and low-income respondents. Socioeconomic status did not influence pamphlet effectiveness
Ramos, Trinidad, Correa and Rivera (2016)	Co-creation, co-design, dialogue, prototyping and brainstorming	The researchers used design thinking to create awareness using a health education program.	Qualitative study	Women's health knowledge increased based on pre-test survey and post-test survey. Design thinking enhanced civic participation and improved community health education
Mummah, King, Gardner and Sutton (2016)	Qualitative interviews, ideation, prototyping and user testing	The researchers used IDEAS framework to guide the design thinking process	Qualitative study	The intervention was feasible, acceptable and efficient. Vegethon prototype facilitated self-monitoring of the vegetables consumed.
McCreary (2010)	ethnography, user observation, deep dives and co-design	An innovation consultancy team used design thinking to champion innovation	Qualitative study	Costs related to patient peace of mind, medical errors and employee satisfaction. The developed innovation

				learning network help healthcare workers share innovation ideas
Fahnrich et al (2015)	Development of personas, design thinking workshops and use of artefacts related to operations about Ebola outbreak responses	Design thinking was used as an intervention to analyze the experiences of Nigerian Field workers and the Ebola Emergency Operations Center	Qualitative study	The authors successfully developed a software, surveillance and outbreak response management system which ensures that surveillance data is available in real time.
Almon (2014)	Ethnography, literature review and survey	The researchers used design thinking as an intervention to discover the unmet needs of adolescents and emerging adults	Mixed method	The researchers recommended 5 design suggestions to help support emerging adults and adolescents.
Goldschmidt and Rodgers (2013)	Ethnography, survey and self-report methods	Design thinking was adopted in efforts to teach students to think creatively and take risks.	Quantitative study	Design thinking help students adopt a business mind
Mosely, Wright and Wrigley (2018)	Workshop, mini-lecture and semi-structured interviews.	The researchers used the design thinking workshop to investigate the effects of design thinking on multidisciplinary collaboration and group teamwork	Qualitative study	design thinking intervention led to improved multidisciplinary collaboration and group teamwork
Hendricks, Conrad, Douglas and Mutsvangwa (2018)	Participant observation, stakeholder interviews	The researchers involved the participants in the design thinking process to determine if the intervention could facilitate	Qualitative study	Design thinking improved stakeholder participation and innovation

		cooperation and more innovations		
Carmel-Gilfilen and Portillo (2016)	Storytelling, observations, benchmarking and interview sessions. Design thinking activities done in 36 weeks. The process included inspiration phase (20 weeks), ideation (12 weeks) and implementation (4 weeks).	The researchers used the empathy-focused design process to ensure that students engage in innovative projects.	Qualitative study	Design thinking intervention led to improved patient-centered care
Vechakul, Shrimali and Sandhu (2015)	12 week pilot study and interviews lasting for 40-60 minutes. The design thinking process lasted for 12 weeks (inspiration-6 weeks, ideation-4 weeks and implementation-2 weeks).	Using design thinking, the researchers developed concepts which can stimulate innovative programs and support community engagement.	Qualitative study	Design thinking expedite the time required to identify problems, design appropriate programs, implement them and enhance community engagement.
Shaikh et al (2017)	Software creation, Referrer Evaluation System Pilot (RESP) and Feedback from Radiologist Addressing Confounding Issues (FRACI)	The researchers created a software system meant to allow clinicians provide feedback to other team members (referring physicians and radiologists)	Quantitative study	The system effectively provide feedback to healthcare workers including radiologist.
Huang, Aitken, Ferris and Cohen, (2018)	Design thinking workshop (empathy, ideation, prototyping and testing activities)	Design thinking aimed at improving public health interventions	Mixed method	Public health researchers applied design thinking skills to solve various public health problems.

When Design Thinking is Appropriate

Design thinking method is suitable when dealing with a complex problem. This method is useful in cases where the problem domain is not fully understood, or there lacks a good proven solution (Brinkhoff, 2018). Complex problems lack proven solutions. Kundal, Chatterjee and Roy (2017) state that complex challenges are ideally addressed using explorative processes, design thinking being one of them. Valentine, Kroll, Bruce, Lim and Mountain (2017) study demonstrated how design thinking is used in handling complex problems facing health and social care. Complex problems are normally connected to human habits, behavior and emotions. Additionally, they are linked to change in behavior, culture and technology as well as development speed.

Through design thinking, a complex problem can be defined and solved. According to Brinkhoff (2018), complex problems are about designing and carrying out experiments to learn from the findings and ultimately converge towards an appropriate solution. In design thinking, researchers perform experiments by creating prototypes and testing assumptions using user groups. The experiments serve as means for researchers to build solutions for users and not themselves. Roberts, Fisher, Trowbridge and Bent (2016) study, for instance, demonstrated how design thinking fosters new methods to complex healthcare problems through rapid prototyping.

Design thinking is suitable when facing human-centered problems. A significant part of the process of design thinking involves understanding human components of the problem, followed by development of ideas considering this understanding (Roberts, Fisher, Trowbridge & Bent, 2016). Researchers are able to create solutions which build on the current needs, behaviors, habits and

wishes of the user, enabling easy adaptation. In design thinking, designers pay attention to end users. In hospitals, Kim, Myers and Allen (2017) found that stakeholders design services and processes with human-centered focus.

When Design Thinking is Not Appropriate

The application of design thinking methodology has some boundary conditions. Design thinking cannot solve all innovation problems (Brinkhoff, 2018). The first step to consider in any design thinking method is which innovation process necessitates the intervention.

Design thinking is inappropriate for closed-ended processes. Design thinking, as revealed by Kim, Myers and Allen (2017), is an exploratory method applied to a problem which lacks an obvious solution. The approach necessitates an open-ended process. To begin the design thinking process, Brinkhoff (2018) recommends having a brief idea of the steps and techniques to approach the problem. Nonetheless, the key insights found during this process determines the eventual process and the final results. This is the reason Valentine, Kroll, Bruce, Lim and Mountain (2017) argue that design thinking methodology is an aggressive territory for any institution that plans for particular outcomes in advance.

Design thinking is inappropriate for organizations that place little value on viable fresh innovation. An organization that is satisfied with ideas generated concerning the current products and services does not require design thinking intervention (Valentine, Kroll, Bruce, Lim & Mountain, 2017). Design thinking methodology becomes redundant if an organization can access all hidden consumer needs, and satisfies the whole market requirements (Kundal, Chatterjee & Roy, 2017). Design thinking is wasteful for businesses that are

currently creating viable, desirable and feasible products that align with their strategic vision.

Design thinking methodology does not help organizations that resist change. Design thinking requires that leaders empower teams to challenge each other positively to bring about effective change (Brinkhoff, 2018). Design thinking supports new approaches to existing problems through diverse and collective teamwork (Roberts, Fisher, Trowbridge & Bent, 2016). Team members have to challenge the status quo. In healthcare, design thinking lets the practitioners improve space designs and develop new products/services (Kim, Myers & Allen, 2017). To solve patient problems, lower treatment costs, achieve improved clinical results and improved patient experience, leaders have to embrace design thinking.

Interventions for Improving Efficiency

There are several training programs for improving efficiency in healthcare. They include design thinking, routinization (checklists and scripts), systems thinking, design sprint and learn startup. These training programs are popularly known for improving efficiency (Keijzer-Broers & de Reuver, 2016; Valentine, Kroll, Bruce, Lim & Mountain, 2017; Silva, Calado, Silva & Nascimento, 2013). Each of these tools has its features that differentiate it from others. Design thinking has some similar features as well as differences when compared to routinization, lean start up, systems thinking and design sprint.

Design Sprint

Design thinking methodology is a philosophy, toolkit or foundation for innovation. However, design sprint is not a toolkit, mindset or philosophy. Instead, it is a particular step-by-step process for producing ideas and testing

them (Keijzer-Broers & de Reuver, 2016). The team identifies the appropriate problem and designs the appropriate solution (Valentine, Kroll, Bruce, Lim & Mountain, 2017). Design sprint process occurs in five days. It involves answering various critical business questions. The questions are answered as the organization identifies an idea, designs (build), prototypes, launch and tests ideas with end users.

Design sprint has some similar characteristics with design thinking. Within five days, a complete product must be built. To avoid failure, it is vital to design a prototype, test the idea in five days. Design sprint is a customer-centered approach that involves learning from the customer (Keijzer-Broers & de Reuver, 2016). A hypothetical solution usually forms the starting point. The solution is then used as a model for learning from the users before making further investment. Moreover, design sprint includes several inconsequential techniques founded on design thinking toolkit (Valentine, Kroll, Bruce, Lim & Mountain, 2017).

Lean Startup

Learn startup methodology has five stages as indicated in Figure 4. It focuses on customer-centered development aimed at creating innovation (Still, 2017). The main activity in lean startup is to convert ideas into products, evaluate customer responses and make the final decision, which may be preserve or pilot. The fundamentals of this technique are build, learn and launch. Lean Startup, according to Silva, Calado, Silva and Nascimento (2013), is a method which seeks to eradicate the waste of resources and time spent on the effort of attempting to understand what consumers really want.

Learn startup has some similarities with design thinking. Business ideas have uncertainty. In lean startup, a minimum viable product (MVP) forms the basis of value delivery. The MVP is similar to a prototype in design thinking. Organizations use MVP to learn investment risks and avoid them (Still, 2017). Design thinking and lean startup interventions are based on learning from end users. In both methods, product development is centered on customers. Both methods have phases that include specific best practices and diverse techniques.

Systems Thinking

Systems thinking refers to a problem-solving method which analyses a given problem within its own system (Mugadza, 2015). The environment interacting with the problem, altogether, form a process which realize the system's goal (Khayal, 2019). This method is frequently referred to systems-based practice (SBP) in healthcare. SBP focuses majorly on the wider setting of patient care in multiple healthcare system layers (Johnson, Miller & Horowitz, 2008). In this regard, physicians must understand how personal practices are related to the wider system.

Systems-based practice is a major competency for health science and medical Member 2essionals. The method pays attention to safety and quality of patient care (Johnson, Miller & Horowitz, 2008). In health sciences and medical Member 2essions, common requirements include the capacity to work in diverse delivery environments effectively, offer patient-centered care, advocate for healthcare quality, detect and prevent medical errors/near misses, coordinate care and compare health costs versus risks. In healthcare, effective implementation and assessment of SBP necessitates a wider understanding of a system and its relationship to systems thinking (Mugadza, 2015).

Design thinking methodology has some similarities with systems thinking. Both interventions are thoughtful. They emphasize detailed understanding of the problems before solutions can be built (Mugadza, 2015). They are non-linear processes. The priority is to get input from real people and iterate the ideas through a cyclic process. What is more, both programs pay attention to innovation. Systems thinking and design thinking look for new methods based on the prior undetected patterns and needs (Buchanan, 2019). As such, researchers can apply the outcomes from empirical research in design thinking to systems thinking.

Various features differentiate systems thinking from design thinking. According to Buchanan (2019), design thinking involves the synthesis process. Synthesis aims to solve a given problem by creating prototype solutions. Therefore, design thinking is a design method. In other words, design thinking is solution oriented (Mugadza, 2015). A prototype for the proposed solution is built and tested using real users. In contrast, system thinking involves analysis. Analysis problem-solving approach aims to break down a problem to solve it. Thus, it is a scientific approach. Systems thinking can be viewed as problem oriented (Buchanan, 2019). You have to understand the problem by creating a systems map.

Systems Thinking is useful in understanding the interrelated nature of the environment in organizations. Design Thinking, in contrast, helps in creativity and designing of innovative ways to practice leadership which can meet the challenges at hand (Buchanan, 2019). A study by Mugadza (2015) gives a straightforward summary of both methods and various continuing

initiatives for integrating the two, while highlighting the benefits that can be realized from the integration.

Systems Thinking is a holistic method in the sense that the understanding of a system begins with the apparent issue, and broadens the system's boundary by increasing the circle to take in those additional factors which may not be so clear, but have an impact on, and are linked to it emphasizing the links and synergy (Buchanan, 2019). On the other hand, design thinking is more human centered, empathetic, and requires the modeler to be inside the problem to design the solution after walking in the shoes of the user affected (Mugadza, 2015). The empathetic angle in the Design Thinking method improves on the holism that the Systems Thinking methodology emphasizes and seeks.

Task Routinization

Routinization means the level to which the task is repetitive (Jung & Nam, 2019; Valenti, 2006). Medical occupations are usually disposed to repetitive tasks (Gold, Park & Punnet, 2006). In dental hygiene, economics are known often be repetitive. The researcher has to identify the methods and routines which enhance patient outcomes. Every dentist needs to establish a routine for doing things. With scripts and checklists, for example, it is possible to establish a routine for the first phone call, new patient exam, best practices in the office, clinical treatment and team training. Routinization is an iterative methodology which underpins design thinking.

In task routinization literature, Jung and Nam (2019) found that routine tasks often help organizations save time and resources, thus proving workers with additional resources required to start creative action. To support this

finding, Ohly, Sonnentag and Pluntke (2006) revealed that routine tasks given employees adequate time to plan, develop and discuss new ideas with their colleagues. Chae and Choi (2019) also agree that routinization encourages innovation in firms. Task routinization positively affects employee creativity championed by supervisors (Ohly, Sonnentag, & Pluntke, 2006).

Use of scripts and checklists is a common practice in dental clinics. Dental practitioners build rapport via nonverbal communication using correct language and suggestions (Appukuttan, 2016). In addition, Lang (2012) states that dental practitioners should help patients feel comfortable by managing psychological risks, lessening pain and stress and increasing satisfaction. One vital component of patient communication commonly used by dental practitioners to realize the mentioned goals is dental scripting. Using a scripts and checklists help practitioners handle different problems that patients may have (Seixas, Costa-Pinto & de Araújo, 2011).

Best Practices in Dental Clinics

Patients usually complain about the difficulty of booking a suitable new appointment. Frustration caused by treatment delays makes most patients avoid visiting dental clinics. The long waiting time and the delay in access to dental clinics is a significant complaint raised by many patients (Katre, 2014). Patients who wait for a long while on dental treatment care are likely to discontinue dental care (Simon et al., 2019). Dental clinics, thus, should upgrade their scheduling systems to smoothen the appointment process. The benefits of a quality scheduling system include easier appointment bookings, reduced stress for staff and patients, better patient flow and optimal productivity (Katre, 2014). Efficient dental clinics require good patient appointment systems. The

appointment system (identifies scheduled patients and events for the staff) is vital as it determines success and failure of dental practices.

Dental clinics need to offer affordable treatments to their patients. Patients are reported to complain about the limited access to the dental staff in most dental clinics during the treatment time, without permission (Nasseh & Vujicic, 2013). Simon et al. (2019) found that financial constraints were the primary reason most patients in dental clinics discontinue their care. Similarly, research done by Seerig et al. (2015) showed that the cost of dental care explains the reason most citizens fail to seek dental clinic services. Given that they cannot afford dental care, they end up developing risks, including tooth loss.

Poor communication from some staff members in dental clinic irritates most patients. Mariño, Ghanim, Morgan and Barrow (2016) raised some issues on dental service providers' capacity to establish excellent communication and rapport with patients. Dental clinics require effective communication (Rowland, 2008). They need more comfortable and faster means to send messages for patients to remain calm during and after dental treatments (Naidoo, 2014). Receptionists responsible for answering telephone calls are required to be discrete and attentive, answer client calls promptly, ask questions tactfully, be responsive, speak distinctively, take calls courteously, avoid sexism and transfer calls carefully.

By communicating more careful with the patients, health care professionals will not alone improve patient happiness, and they will enhance their work satisfaction as well (Lang, 2012). Recognition of each patient's communicative favourites and knowing their preferences will permit healthcare professionals to accommodate to the patient's case of mind considerably

facilitating the informative manner. Also, the proper use of recommendations will help additional ease the path towards a reciprocally satisfying communication between the healthcare professional and patient (Wagner & Redford-Badwal, 2008).

Simon et al. (2019) showed that dental healthcare providers should consider applying interventions to help dental patients in obtaining suitable treatment, for instance, patient navigators, interpreter services and payment plans. In support of this finding, Nápoles et al. (2010) study demonstrated that patient satisfaction is higher when healthcare providers avail interpreter services. Moreover, satisfaction is higher for telephone interpreter services. Furthermore, an activity that enables better communication between dental health providers, patients and the staff may help in creating a smooth change for the patients seeking dental treatments.

Proper treatment, particular in dental treatment, requires evidence-based dentistry practices (Katre, 2014). Some patients are treated very faster by dental practitioners making the treatment ineffective. In most cases, the dentists rush through their procedures while administering treatment without following standard processes. To address this problem (Haron, Sabti & Omar, 2012) suggest that clinical decisions and treatments must be made, taking into account evidence-based sources. This practice help dentists administer effective treatments.

Dentistry is a practice which requires practitioners to address daily challenges. The foremost aspect entails keeping up with the current treatment techniques and materials (Kishore et al., 2014). Patients usually complain about improper treatment for their dental problems. Negative side effects prevent most

patients from making other dental care appointments (Naidoo, 2014). It is significant that dentists and physicians, as healthcare providers, offer the best conceivable care for all of their patients. This practice requires a sound educational base and a good source of the up-to-date best evidence that supports their treatment recommendations (Haron, Sabti & Omar, 2012).

Dentists have one key role, which involves providing quality oral healthcare and dental healthcare (Katre, 2014). Nonetheless, some dentists have a bad reputation due to poor service delivery. Some employees are neglectful. For this reason, some patients experience anxiety while undergoing treatment in dental clinics. Patients complain about this problem. Patients that are drawn to the dental clinic setting find qualities such as provider-patient interaction as well as the quality of the interaction to be more important (Simon et al., 2019).

Staff in dental clinics usually complain about the delay caused by patients in attending their appointments. Receptionists need to be well equipped with pertinent information and schedule appointments where patients can take the least time possible to get treatment (Katre, 2014). Most

patients prefer a shorter time to get help ones they have made their appointments. Nonetheless, some cause the delay. Long waits during appointments reduce patient satisfaction. Thus, staff should strive to ensure that there are no delays during dentist appointments (Simon et al., 2019).

There is a necessity for dental practitioners to engage their patients. A dental practice requires to depend on patients who frequently visit the dentist for treatments and are willing to recommend the dental practice to friends and family members. Sometimes, dental clinics make inadequate arrangements with emergency patients (Kishore et al., 2014). Retaining most of the existing dental

patients goes beyond providing excellent services, easy to access treatment locations and convenient hours. Research recommends that dental practitioners engage patients often, create long-lasting relationships and earn their trust (Rowland, 2008).

Rowland (2008) found that language barrier influences the staff's ability to work appropriately in dental clinics. Some patients are too challenging to deal with, especially if the healthcare provider does not understand their primary language of communication (Naidoo, 2014). Evidently points out that patients with a language barrier are most likely to discontinue dental care (Simon et al., 2019). There is thus needed to promote practices which help overcome the language barrier between dental technicians, dentists and patients. Measures aimed at addressing language barrier help improve dental knowledge, dental access and oral health (Rowland, 2008).

The physical environment and the office culture profoundly influence treatments in dental clinics. Culture informs leadership styles, personality, staff behaviours, systems and values, their expectations, and how they communicate or deal with each other as well as patients. The way the staff run the dental practice impact treatments provided and patient satisfaction. Sometimes, receptionists in dental clinics lack knowledge on dealing with patients before they can be sent to the dentist for examination. Das et al. (2018) recommend that clinics should adopt a dental practice which attracts quality and experienced staff, boost productivity and increases the patient return rate.

Effective dental treatments necessitate dentists to capture all pertinent patient information before commencing treatment (Naidoo, 2014). In some incidences, patients provide dentists with false information concerning their

health. Some fail to mention common illnesses they may have apart from dental problems, such as diabetes and blood pressure. Simon et al. (2019) study indicated that care providers, practitioners and patients often share a unique relationship. While sometimes patients may entrust their respective providers with confidential information, some hide details as they feel embarrassed to share them, which are later not captured in their medical history.

Cultural influences clearly overlap with dental health literacy in complicated ways. Wagner and Redford-Badwal (2008) study identified deep cultural knowledge and skills among dental graduates. Mariño, Ghanim, Morgan and Barrow (2016) recommended that to deal with this challenge (cultural barrier), there is need to train and educate dental healthcare providers who are linguistically and culturally competent, mature and thoughtful enough to understand dental practices, well-versed with various cultural practices, beliefs and traditions. Cultural competence implies that professional in healthcare can work in cross-cultural circumstances effectively. In this regard, culturally competent health service providers offer the best care to each patient irrespective of ethnicity, literacy, cultural background or race.

Cultural differences make it for dental staff to deal with patients (Wagner & Redford-Badwal, 2008). Dental practices are commonly influenced by patient culture as well as the culture of their attendants. Some health beliefs are culturally influenced (Mariño, Ghanim, Morgan & Barrow, 2016). The staff needs knowledge that can help them identify their cultural values, a key step that can help them accept cultural disparities in the dental care setting (Naidoo, 2014). Accordingly, dentists should be ready to serve a culturally diverse patient populace (Donate-Bartfield, Lobb & Roucka, 2014).

Wagner and Redford-Badwal (2008) research found that patient culture serves a key role in the delivery of dental care. Donate-Bartfield, Lobb and Roucka (2014) state that staff members should be competent and manage a diverse patient populace and possess communication and interpersonal skills which enable them to function in multi-cultural workplaces. The staff are required to adopt approaches that address cultural disparities. Moreover, they have to effectively interplay with different patient populations and understand the way cultural influences interplay with psychological, situational and social variables influencing patient behaviour (Wagner & Redford-Badwal, 2008).

Dental Ethics is closely related to the law. The dental practice is guided by legal aspects, including patient consent, dental practitioner liabilities, determination of negligence and professional, ethical standards (Bhadauria et al., 2018). Dental clinics lack laws protecting the employees from the administration. People, especially patients, can challenge professional services rendered by dentists (Vashist et al., 2014). To avoid conflict, dentists must act in line with the highest ethical standards to protect their practices and the lives of their patients.

Das et al. (2018) argued that to encourage patients to seek regular dental treatments, clinics need to attract new patients and keep them. For achieve this, the best practice is to seek input from staff members, including receptionists, secretaries, front-desk persons and business assistants. Dental clinics require qualified staff, which is an asset (Vashist et al., 2014). Most clinics need to establish guidelines which guide the recruitment of qualified staff, creating a competitive compensation scale reflecting productivity and establishing innovative teams.

Chapter 3 Methodology

Research Design

The research method was adopted in this investigation is a mixed-method approach. This approach combines qualitative and quantitative techniques. In the quantitative method, Orcher (2014) noted that the investigator uses descriptive and inferential statistics to describe and define the population and deduce the sample results to a broader population. There is a need in this study to test the effectiveness of design thinking constructs in predicting the behaviour of staff and perceptions of the patients in the dental care setting. According to Yin (2014), a qualitative approach normally explores a phenomenon. A qualitative methodology is thus adopted here to explore the significant outcomes linked to design thinking intervention.

The actual design choice we were using for this study is mixed explanatory methods. The mixed method includes quantitative and qualitative elements such that quantitative and qualitative information can complement each other. Data collection and data analysis are done efficiently using this method. Explanatory mixed methods, the researcher collects qualitative data, then quantitative data (Creswell, 2013).

In the design thinking method, quantitative and qualitative research methods are usually applied to meet aims to be realized in all design phases. A quantitative technique is employed to investigate the observations done and record the relevant data. The research process is carried out into different stages, including pre-survey, actual design thinking intervention and post-survey. In the analysis, the main variables analysed include staff attributes, dentists' initiatives, physical facilities and patients experience.

The pre-survey was conducted to examine patients' experiences with dental clinic team. The initial empirical phase entails obtaining patient views considering their experiences in dental clinics, with a focus on collaboration, communication and satisfaction with treatment results. Here, the emphasis is on exploring beliefs, meanings and values about service delivery in dental clinics. For this reason, quantitative approach is one of some instruments fitting. The survey questionnaire is selected as one of the instruments used to collect primary data. Creswell (2014) has documented the main strengths and demerits of questionnaires.

Participatory design workshops are conducted in this research. The aim is to include healthcare practitioners through the design process for them to obtain insights into means in which proposed design thinking can be implemented in improving patient experiences. The workshop helped identify design thinking features and elements preferred by patients in dental clinics within scenario works. The method is informed theoretically by the previous work by Robinson et al. (2009) who used participatory design to build prototype technologies which improve independence with individuals with dementia.

The researcher facilitated the workshop as the moderator, giving training on design thinking methodology to the experimental group. Each discussion started with the introduction showing explanations about the discussion format and all participants being confirmed of confidentiality regarding the data exchanges. The aims of each discussion were described.

The interviews questionnaire was conducted with seven patients and seven of the staff in pre-intervention. The same number of participants were interviewed after the intervention. A survey questionnaire was distributed to the

staff and patients during three months before the (DT) intervention. The staff applied the solutions which were obtained from the workshops to the patients for four months. During this time, a post-survey was presented for the patients and staff including receptionists, dentists, dental assistants and administrators. After one month of the intervention immediately, there was another workshop conducted regarding (iteration), then after two months of the intervention, there was the last workshop which was conducted regarding the routinization approach.

Research Procedures

The sample includes the patients and all the staff. For distributing the survey questionnaire to the patients, one of the receptionists was recruited by coordination with the complex manager in assisting me in recruiting the patients to fill out the survey after finishing their treatment. Moreover, there was another survey questionnaire for the staff was distributed online by the clinics manager through their internal email. In the second step, there were interviews with seven of the patients randomly to understand their experiences in-depth. The interview took about 30 mins face-to-face by PI in the same complex, as well as the same way with different interview questions were conducted with seven of the staff randomly. In the interview, informed consent was obtained from each participant by PI. Also, there was observation (simple observation and non-participant) for three hours daily in three days by the PI to understand the process of patients flow as well as to understand the clinic environment to prepare for the workshop at the complex. In the intervention step, there was a suitable area in the complex to start the workshop and the practice. The

workshop took seven days of discussion, two hours daily, and was practical during their work.

The workshop was an explanation of the methodology of design thinking and application of the stages in the period scheduled for the workshop. The participants were informed to think about a workplace improvement initiative to discuss during the course. The participants were dentists, dental assistants, receptionists and administrators. The materials used include flip chart papers, colour markers, A4 paper, pens. Workshop materials included presentation slides, worksheets, learner's guide, laser pointer, clicker. One of the aims of the workshop was to find out the challenging problems and their appropriate solutions. For avoiding the effects that might be influenced by the external factors, the solutions derived from the workshop were applied directly for four months, after two weeks of the workshop, we conducted the fourth step which was the post-interviews with seven patients and seven staff.

Study Setting

This study is conducting at Elite's smile specialized medical complex. Seven dental clinics in one complex were used for this study, in Saudi Arabia, in the city of Taif. Taif is in the west of Saudi Arabia. The location of the city of Taif is a junction of the main roads coming from the east, west, north and south, which helped them to gain a tourist reputation, commercial and agricultural from a long time. Besides, it became the unofficial summer capital of the state.

Population

The population of this study was the total of the staff 28, 14 staff in the management, seven dentists and seven dental assistants at Elite's smile

specialized medical complex, and the patients who were visiting the clinics every day.

The Sample

Selecting the sample correctly is an essential element in the success of the scientific study. The sample included dental staff (receptionists, dentists, dental assistants and the other staff in the management) and patients. The sample filled out the pre-survey questionnaire and post-survey questionnaire.

The study took place in dental clinics operating in Saudi Arabia, and the clinics provide dental health services to many patients. Twenty-two subjects included in the experimental design of this study. The participants comprise of eight staff administrators, seven dentists and seven dental assistants.

We used a random sampling of patients who were visiting the seven clinics. This technique is preferred because it gives everyone in the population the opportunity and likelihood of being chosen in the sample.

Participants

The inclusion criteria regarding the patients were: 1) The average of patients who come to clinics for three months before the intervention; 2) All patients with any health condition. The exclusion criteria regarding the patients were; 1) Patients with neurological conditions which influence their functioning. The inclusion criteria regarding the staff, dentists and nurses were; 1) All the staff who are interesting to learning this methodology. The exclusion criteria regarding the staff, dentists and nurses were, 1) Staff who enjoy their vacation. All these criteria applied after getting consent from all participants.

Validity of Instruments

In order to conduct a validity test, the questionnaire was sent to experts to validate it. The panel experts tested the validity of an instrument. The experts were determining the accuracy of the questionnaire. In this research, face validity and construct validity were employed as a validity assessing method and expert's opinions were used to determine the validity of the construct and instrument.

Pilot Test

van Teijlingen & Hundley (2001) define pilot test as feasibility (small version of the full scale) study. Pilot testing entails determining whether the survey, main informant interview guide and observation formwork in the actual world by trying out on a few people first. The reason of pilot tests is to ensure that each person in the sample chosen understands the questions similarly. Moreover, pilot tests point out problems regarding test instructions, instances in which items seem unclear and typographical (formatting) issues or errors (Billé, 2010). A retrospective interview was used during pilot testing. A pilot test in this investigation helped determine questions which make the respondents uncomfortable and the time required to complete the survey. The pilot test was conducted before the actual research to ascertain the reliability of the intended construct. For this pilot testing purpose, some questionnaires n=40 of patients were administered and tested. The pilot test was conducted to test the reliability and validity of the instruments above. Given the workshop, the main aim of the pilot test was to ensure that all the needs are provided. Moreover, to prepare the facilitator to be ready directly from the first session in the workshop. It was conducted with some people outside the sample as well as not from the intended

dental clinics complex to see if the participants can easily understand the contents and to amend the uncertainty accordingly.

Design Thinking Intervention

Design Thinking Workshops assist professionals in how to solve problems. Starting with understanding the problem and patient's needs, then create ideas, develop the prototype, and next test it with the customer. The principal ultimate aim is to transfer the design thinking knowledge and implement the solutions in dental clinics to enhance patient experiences. In the intervention, the subjects learn about the design thinking processes, prototyping and enhancing patient experiences incrementally. They were required to practice how to employ the solutions to the problems that gained in a design challenge, where they offer treatments to various patients.

The intervention attempted to increase the practitioner's awareness and knowledge about the adoption of design thinking into dental clinics. It was described by collaboration among the staff, dentists, dental assistants and patients. It is patient-oriented, a flexible approach to enhancing patient experience among the treatment. Through the brainstorming sessions and talks, the dentists, dental assistants and the staff evaluated patients' experiences and produce requirements supported by the data obtained from the workshop sessions.

The Need for Design Thinking Training

Design thinking training is essential to help the research participants learn the skills required to build teamwork to handle complex challenges faced in dental clinics (Kumar, 2012). The training equipped all dental healthcare practitioners by tools and methods essential for creatively solving dental

problems. The team were empowered to apply the design thinking processes practically into their daily routines, thus improving the patient experience.

Training Program Expectations

The participants acquired knowledge on design thinking methodology. The participants became more experimental thereby opening their creative potential. A more patient, and collaborative team were created. Participants learned to share insights, collecting feedback and presenting hands-on activities. The team got a fresh knowledge which expanded members' thinking such that increased practical ideas were generated in attempts to improve patient experiences.

Design Thinking Training

The researcher and the research team's approach were to offer a practical and very interactive workshop for dental health workers to learn design thinking processes and methods. We shared some tools and approaches commonly used when adopting design thinking method. Besides, we used the workshop to connect all participants to significant design thinking techniques, books and toolkits that help improve patient experiences in dental clinics. Apart from learning to utilize design thinking techniques and methods, the participants need to develop an attitude of decision thinkers who focus on continuous innovation (Criscitelli & Goodwin, 2017).

The design thinking workshop is meant to champion innovation among healthcare providers and the staff. Innovation leads to positive change (Kumar, 2012). The staff and service providers, through innovation, can respond to massive changes encountered daily during service delivery (Lawrence, Schneider, Stickdorn & Hormess, 2018). Through design thinking,

organizations become more successful in addressing change by considering and including users and customers in product creation and service delivery.

Design Thinking Process

We customized the design thinking workshop to match the dental healthcare practices with the overall design thinking process which comprises of five stages, namely empathize, define, ideate, prototype and test (d. school, 2010). These steps are the same across several systems. The underlying purpose of this workshop was to design a system for improving patient experiences in dental clinics through innovative solutions.

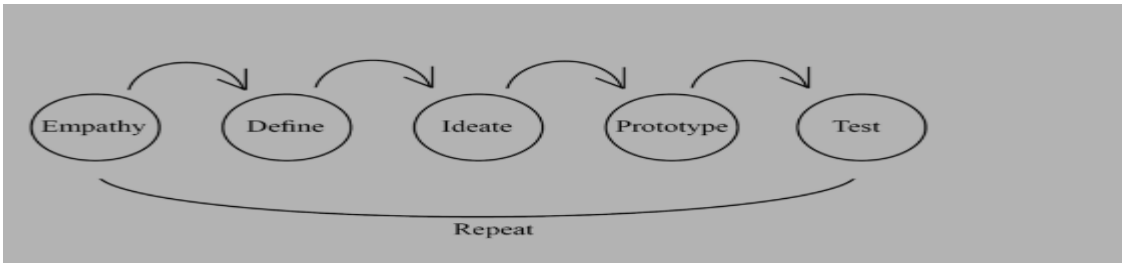


Figure 2: Design thinking process

Adapted from (d. school, 2010)

Through the whole processes, the participants need to:

· Clarify the problem with various focused questions for customers. This entails Studying the processes and flow of patients seeking dental services

· Create numerous ideas for addressing the clarified problem with patients in mind

· Validate the solution, communicate it to colleagues and officially launch it for daily practices.

Design Thinking Scope

The participants were comprised of the dental staff. The workshops took seven days. In the session, participants learned the meaning and application of

design thinking and the reasons this approach is powerful for success in modern organizations. The participants discovered their innovation mindset so that they begin practical activities that improve patient experiences. They needed to gain empathy into the patients' needs and applied the learning obtained into a specific method or system which gives patients what they want with regards to dental services.

Objectives:

Apply the learnt solutions of design thinking process in daily work.

Develop a design thinking mindset which fosters innovation.

Use design thinking techniques and tools in the clinical setting.

Work together with colleague staff to generate new solutions to dental healthcare needs or challenges.

Workshop Activities

Stakeholder persona development-share the current practices in groups and note down the gaps in dental practices.

Assign all stakeholders included various responsibilities.

Demonstration of the d. school (2010) design thinking process applied at Stanford.

Design thinking mindset metaphors and stories.

Discussions among colleagues.

Idea generation for colleagues to suggestion innovations required in dental practice.

Concept development from the patient community.

Validation activity through testing of prototypes.

Design thinking workshop

Design thinking workshop outlines:

Session	Design Thinking Methodology Workshop	Learning item	Results
1	Introduce the participants' predictions and their tendencies from the workshop. Discuss the current issues and how they solve their problems. Determine the strengths and weaknesses. Discuss the extent to which they want to improve the patient experience.	Understanding design thinking	The participants will understand the workshop aims. Preparing them for the next sessions.
2	Give a general idea of innovation, in general, and its benefits in the growth of the organization and improving patient services. Explain the top innovation methodologies and then expand on and illustrate design thinking methodology, including its definitions, purpose, and processes and how it develops. Play a set of videos for the participants with all the tools that will be used in the design thinking process. Use the (d.school) design thinking processes. Five principles applied to design thinking will be embodied in the process, namely empathizing, defining, ideating, prototyping, and testing.	Understanding design thinking	The participants understand design thinking basis Participants understand tools applied in their workplaces Participants develop a patient-centric mindset
3	Starting by applying the first process in the design thinking process, which is empathy. The staff, dentists, and nurses will train to conduct the indirect observation, interview with the patients, and how to put themselves in the patients' positions in the future. The findings (pain points of patients, pain points of staff, needs and requirements of patients, needs and requirements of staff, and existing processes and systems) will be discussed during this session. Tools include Empathy Map, Problem Tree and Journey Mapping.	Application of design thinking	Out-of-the-box thinking (innovative patient-centric thinking) Capacity for the participants to apply the solutions of design thinking on their respective jobs

4	Asking the participants to move to the second process, which is defining. Compile all details, define the problem and study objective, and build a team. The staff, dentists, and dental assistant will sit together and define the problem to arrive at a thorough definition after filtering the information resulting from the first step, analyzing it objectively and scientifically, and identify the problems in a way that leads to an accurate definition. Tools include question Ladder, Persona development, Affinity Diagram	Application of design thinking	
5	After identifying the problems, participants are asked to start the Ideate process, convene, brainstorm, prioritize ideas based on the findings of defined problems, identify five target areas that require improvements. No limitations exist regarding the processes that can be used to arrive at these ideas at this stage, For example, coming up with as many ideas as possible, using the worst idea method (the crazier and more out of the box), allow for a lot of freedom and expression, no bad ideas, the purpose here, is to encourage participants to put their ideas. There will be some questions that can help like, what can be done to solve the problem? What do patients need, and how can this be presented to them? How can existing solutions/innovations be changed/adapted/modified to the needs of the patients? How can the experience change? How can the process/system be more effective/efficient? Can current trends be built upon? What are the possibilities? Tools include Lotus blossom, SCAMPER, Sense Storming.	Application of design thinking	

6	In this session, they will be required to start the fourth process of design thinking, which is developing the prototype that will be translated into a product or service. At this stage, the first model, which is based on the implementation of the proposed ideas, is designed to identify what is compatible with the project and put the plan into practice. Here is the first form of a solution, which can be applied and tested in general. There will be some questions that can help like What needs to be changed to fit the user's needs? What works? What does not work? What elements can be taken forward? What are the metrics for success? Tools include Role-Playing/Enactments, Concept Sketches, Storyboards.	Application of design thinking	Capacity for the participants to apply the solutions of design thinking on their respective jobs
7	At this stage, the participants are asked to implement the final stage, which is the test (implementation). In which the user accepts the solutions and will be considered to be in the improvement and development in successive stages. Design thinking is also based around learning to "fail fast,". Make the patient try! This is the way to identify and evaluate the solution. The product is presented to the patients, who are left to try the service, so we can watch how they deal with them without explaining how to use them. This way, we can detect whether the product or service is accepted, and the user has the option to modify it. This stage marks the first experience of the user, so the product can be known for its effectiveness. At the end of the experiment, the new functions can be explained. There will be some questions that can help like What are the goals? What processes will get us into the goal? What are the constraints? What are the current requirements? What are the future requirements? What are the guiding principles? How do we communicate with users? Tools include Strategic Roadmap.	Experimentation	Tangible experiments Proper understanding of experimentation Feedback provided by patients

7	In this session, Discuss the full understanding of the processes and review them. Then, ask the participants to apply the solutions for the patients for three months. The iteration will be discussed and how can we arrange for other sessions for one month after the intervention directly. Discuss the benefit of iteration and the processes that will be used in this process.	Experimentation	Understanding the iteration process and its benefits

Data Collection

A questionnaire was distributed on the patients and all the staff during three months before the DT intervention and three months after the workshop intervention. Several aspects of dental service provision investigated through a retrospective questionnaire in efforts to gather quantitative data. A post-survey was conducted for the patients and all staff including receptionists, the directors, dentists, and dental assistants. To complement the quantitative findings, interviews were used. We conducted interviews with both patients and staff members.

Design Thinking Intervention

A design thinking workshop was used as an intervention in this study. This design thinking workshop was carried out to help dental practitioners solve a real-world problem and offer improved dental care. Participant includes dentists, dental assistants, office receptionists, nurses, and administrators. The training included seven sessions. As a researcher, we took the dental staff through various stages of design thinking. The participants underwent training involving seven sessions. The participants comprised of multidisciplinary teams, including dentists, dental assistants, office receptionists, nurses, and administrators.

We evaluated staff behaviour and responses before and after the training session. Using the workshop, we evaluated the behaviour of all participants, their attitude and performance levels before the training and after the training (between the first session and the 7th session).

We conducted a three-day training on using scripts and checklists — the dental team comprising of receptionists, nursing, lab technicians, dental assistants, and dentists. Role-playing learning structure allowed the staff (learners) to immediately apply the content learnt about routinization as they are put in the position of a decision-maker who necessity make a decision about a dental policy, resource allocation, or other results related to patients.

We used scripts to establish routines for all personnel, including receptionists, dentists, dental assistants, and managers. In training, we tought the staff on using scripts which include instructions that must be followed when interacting with patients and expected behaviour among the medical staff.

Training Program for Routines

The best training program for the scripts and routines is soft skills development training. Soft skills are vital for employee growth. Soft skills imply personal attributes that allow employees to cooperate effectively and harmoniously among other people in the workplace, including co-workers, administration, and consumers. This kind of training assists improves personal ability, time management, interaction and people control in the whole dental practice.

Soft skills training were useful for new and existing employees of all levels. It is an extremely effective way to build an efficient, respectful and collaborative culture – ultimately affecting the bottom line. The training

covered problem-solving skills, communication, telephone etiquette, teamwork, conflict resolution, ethics and time management. These skills are vital in dental areas such as greeting patients, waiting delays, treatment cost, treatment pain, next patient appointments and post-treatment care.

Group discussions and activities should facilitate the workshop. For the right group of workers, group discussions and activities can implement the ideal training option. It admits multiple workers to train at once, in an environment that much fits their current jobs or groups.

Training component	Description
Needs assessment	Identifying the needs of the personnel and addressing them. The assessment evaluates areas that require improvement to guarantee positive patient experience e.g. communication, telephone use, treatment and handling delays. Discussing the significance of scripts and checklists in each area identified
Learning objectives	These are measures which will reveal that participants have obtained the required knowledge and skills after undergoing the training. The following list outlines the core objectives and learning outcomes for the whole dental team receiving the training: 1. Cover all skills, behavior and knowledge required to improve dental practices: professionalism, leadership and communication 2. Work efficiently with other dental personnel to improve patient experiences 3. Meet the current oral healthcare needs 4. Increase patient focus, putting patient's needs and interests first
Learning style	Spatial/visual learning is the most preferred style in this training. The instructor usually uses images, pictures and drawings to promote special understanding (Aldosari, Aljabaa, Al-Sehaibany & Albarakati, 2018). The personnel undergoing the training will be required to make observations about written directions (scripts), charts, pictures and diagrams illustrative routines. Use a whiteboard. As an instructor, use PowerPoint presentations and handouts with visual aids for all participants to understand. Participants should be given enough time to work through all information given.
Delivery mode	This training should be administered through face-to-face learning. The training takes place in the face-to-face context. The instructor and the trainees communicate and collaborate, working together on the topics under discussion. The trainees will take listen actively and take notes as the instructor presents the training program content. Collaborative group discussions will be encouraged to explore opinions, debate and analyze judgments.

Delivery method	The best delivery method in this training is role play. In this method, participants assume the roles and act out scenarios likely to take place in the work setting. Role playing seeks to help participants learn, develop or improve on the competencies and skills essential for the specified position (Sogunro, 2004). The employees, through this method, will learn skills on how to address different situations they are likely to face. This training method is effective for trainings involving interpersonal skills, because it is interactive. Scripting training will majorly focus on interpersonal skills for all dental practice personnel. Benefits Make the training more enjoyable Interactive sessions help keep all trainees involved in the training, making them more open to new information passed to them We will get in-session feedback on learning and training outcomes
Content development	As the instructor, I will research, write, gather, organize, and edit the information for publication and training. I have already prepared slides on scripts and checklists on Microsoft PowerPoint. The next step is to present the content to the participants during the training.
Measuring effectiveness	Various measures are used to assess the effectiveness of training programs. In this training, we use the following: 1. Observing the reaction of all learners to the training, its usefulness and relevance. We can use the surveys or talk to them before the training and after the training to gather their feedback regarding the whole training experience. Asking questions on the relevance of the training content in dental practice, key takeaways, strengths and weaknesses. 2. Measure skills and knowledge gained after the training. Evaluating applied learning projects, course completion/certification, impact on dental practice KPIs (e.g. waiting time, courtesy during conversations, follow-up treatments) and supervisor feedback. 3. Quantified the tangible results of the training e.g. increased productivity, reduced waiting time, improved quality, higher morale, faster completion of treatments and patient loyalty.

Data Collection in The Workshop

The results provided were used to document the design thinking effects. Another source of data included responses to the questionnaire for healthcare practitioners with questions regarding the overall experience of the participants before the design thinking intervention and after the design thinking intervention.

Depending on the problems collected, the participants defined the problems in dental services and find the appropriate solutions that improve patient experiences after using the design thinking processes. After that, the participants implemented the solution as the test process in design thinking. They were required to iterate the process in case there is no impact on the solution suggested. The process was repeated until the team finds another solution that solves the problem. This means the participants tested the prototype (product or service) directly after finishing the workshop.

Observation Elements

As a construct, design thinking requires validation. Design thinking, as suggested by Rapp (2016), should include consistent practices across the whole organization studied. In this regard, the components observed during the workshop should be consistent across all dental clinics included in this research. The following practices, thus, were observed:

- Development of empathic understanding of patients' context and needs in the dental clinics
- The creation of heterogeneous teams for collaboration reasons
- Dialogue-based discussions and conversations among all participants
- The presentation of multiple solutions derived from experimentation
- Use of a facilitated process, i.e. the researcher and the research team oversee the whole training

Materials

Some of the materials that were used or distributed to the participants before, and during the workshop and after the intervention are; 1)slides An Introduction to Design Thinking PROCESS GUIDE - d.school referring to this link

https://dschool-old.stanford.edu/sandbox/groups/designresources/wiki/36873/attachments/74b3d/ModeGuideBOOTCAMP2010L.pdf. 2) some chosen videos that give them a brief idea about design thinking. 3) Materials that were used include flip chart papers, Paper/Writing material of various sizes, colour markers, Sticky notes, Visual aids, A4 paper, pens. 4) Training materials include presentation slides, worksheets, learner's guide, laser pointer clicker.

Data Collection (Survey, Interview)

To evaluate the effects of design thinking, this study examined the practitioners to determine if they can apply the design thinking in their clinics and how they can improve the patient experience. For this reason, a survey questionnaire, interview and observation are administered to determine innovation in service delivery considering the views of professional healthcare practitioners and patients. The survey and interview were administered to all the participants, including the dentists, dental assistants, staff and patients. Pre-experience and post-experience surveys and interview are administered to assess patient experience in dental clinics. Several aspects of dental service provision are investigated through a retrospective questionnaire.

Participants were contacted using phone one week before the intervention and be asked to participate in the training on design thinking application in the dental setting. To examine the impact of design thinking, there is a need to evaluate changes in measurable outcomes, changes in staff perception, changes in thinking and changes in the patient experience. The three months follow up were also useful in this case. Improvements were assessed by

comparing various rate improvements realized across the intervention period, before and after design thinking intervention.

Ethical Considerations

This study was approved by the Institutional review board (IRB) at Singapore Management University (SMU). The reason is that human subjects were required to participate. Moreover, the study relies exclusively on the de-identified data including physically identifiable characteristics and geographical location details. From the IRB committee perspective, consent is essential in such a study. The ethics committee, thus, reviewed and approved the study before it is conducted in Saudi Arabia. All patients and staff are giving written informed consent before they can complete the research instrument. The form is showing to the patients a statement showing the purpose, benefits and the risks related to voluntary participation.

Chapter 4 Conducting The Workshop

Workshop Objectives

In this workshop training, the trainer required the participants to learn

• The skills, behaviour and knowledge required to improve dental practices through design thinking: this includes professionalism, leadership, interaction with patients and communication

• Prepare for training on design thinking

• How to work efficiently with other dental personnel to improve patient experiences

• meet the current oral healthcare needs

• how to increase patient focus, putting patient's needs and interests first

• use simple materials to design low-fidelity prototypes

• foster a work environment which gives room for ideation and innovation

Workshop summary

By keeping in touch with the research team, the researcher acted as the trainer in the workshop training and facilitated the whole process using Arabic and English language. The whole workshop included seven sessions. This design thinking workshop was carried out to help dental practitioners solve a real-world problem and offer improved dental care. Being the trainer who hosted the workshop, we started the workshop, presented the training sessions, examined the participants and their experiences, helped the participants to ideate and explore problems in dental care, prototype ideas and test desirable solutions. We also talked about the subsequent steps.

The workshop participants included dentists, dental assistants, office receptionists and managers.

The workshop was conducted from 9:00 pm to 11 pm. Sometimes, the training could take 15 minutes before or after the exact mentioned time. It is essential to visualise the workshop structure. We started each session by putting some pictures of the tools on the wall for more straightforward visualisation during the training. For instance, I put the empathy map and other tools on the wall to let all the participants see it all the time.

The first session of the design thinking workshop

Overview

The objective of this session was to prepare all participants for the whole design thinking workshop. The goal of the session was to give the participants a preview of the design thinking method. In this session, the participants were required to learn the fundamentals of the whole design thinking training workshop. My approach was to provide a practical and interactive workshop to help dental practitioners get started with design thinking in which they would learn by doing.

Objectives

- Develop a mentality for design thinking and healthcare innovation
- Apply the design thinking process to the dental practice
- Use design thinking tools and techniques
- Collaborate with other staff to generate new solutions to dental clinic needs and challenges.

Workshop agenda

This session required 120 minutes. The main tasks carried out were setting up the participants for the activity, helping the team understand design thinking to get started, carrying out role-play activities, reflecting on the day accomplishments as one team, discussing the content and sharing our ideas and breaking so as to reassemble during the next session/day.

On the first day, I introduced myself to the participants and explained my role. As the trainer, my key role was to engage all participants in the training through various exercises and activities that demonstrate design thinking. I started the session by greeting and thanking the dental practitioners for volunteering to

come to the workshop. I then gave them brief information about the workshop and the sessions required for each day.

Before carrying out any intervention, the researcher should request permission first. In this regard, I distributed the informed consent forms, and I gave them enough time to readm and sign them. The forms served as voluntary agreement by the participants to engage in the workshop. Before signing the forms, the participants were required to understand the workshop, its benefits as well as risks. This session was about introducing the participants to the whole workshop, prediction of training aims and the essential tendencies during the whole workshop.

Framing the problem

Framing the problem involved defining the dental challenge. We discussed the current issues and problems in dental care and how they solve their daily problems. The key issues included dental therapy, dental fillings coming out within a short period of time, treatment plans and fees being dictated by third parties, low-quality practices, mid-level dental workers, populace diversity versus patient needs and dentists cracking healthy teeth during treatment. During the discussion, one of the receptionists said: "When we discuss any issue in this clinic, we always take too much time, and forget to find the solutions for the issues in the end".

I tried to evaluate the participants' desire for improving patient experience and staff efficiency. Most of them were willing to immerse in this workshop to improve their efficiency and enhance the patient experience. The participants were given the opportunities to ask questions related to the workshop, delivery

and outcomes. Most questions came from the dentists and the administration staff. Some questions that came from the participants are:

1) What is design thinking methodology?; 2) Can it help us?; 3) How can it help us?

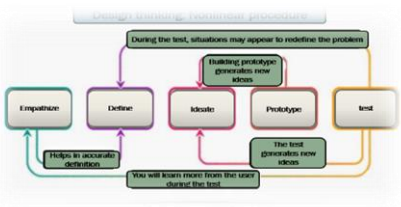
Solutions

As the leading trainer, I answered all the questions. For example, I gave the following response to answer the first question: “Design thinking is systematic and creative method helps innovate, and solve problems, teaches workers how to be more empathetic and effective, enables creativity and lateral thinking, helps the team learn how to gain insights and analyse findings and can be used to create holistic and sustainable solutions”. In the dental care context, the objective of design thinking is thus to provide guiding principles.

I clarified that innovate ideas are not exclusive to experts and smart people. Essentially, for successful innovation, science and art that can be used, learned, trained and then exercised by anyone. Innovation can include marketing, emotions, relationship formation, technology, functions, experience and processes. I elaborated about how collaboration, teamwork, co-creation and multidisciplinary practises are important in design thinking.

The focus of the first session was problem identification. The outcome of the first session was that the participants understood the workshop aims, their roles and the expected learning objectives. I also prepared them for the next sessions.

The second session of the design thinking workshop



I explained all the processes and how can be iterated during the next processes

Design thinking

Design thinking is a systematic and creative method of thinking that helps you to better study the situation to identify the uncertain problems and develop appropriate solutions to solve those problems.

Stages of design thinking

1-Understanding & Empathy: Put yourself in the place of the patient and try to imagine his impressions. The more you imagine the better. Try to live a traditional experience for this patient in his surroundings to learn about his problems and challenges, what he likes and does not like. What make him feel upset and depressed and what make him happy.
You will not understand these problems alone but you need to interview a sample of patients to hear their experiences and situations in their tongue. Be careful in writing what you hear from them and do not be superficial. Note how their words and facial expressions. Ask them open questions also to come up with success stories and failures, and look for unmet needs.

2-Define the problem: Filter the information you collected in the first stage and classify it so that you can determine the nature of the existing problems and then decide which problem you will start to solve. Make sure you choose a problem that concerns a wide range of patients, so that when it is resolved, a large segment has benefited and feels the change.

3-Ideate(brainstorming solutions): This is the time of brainstorming solutions. Once you have identified the problem, you will think about how to solve it. It is always better to brainstorm in groups to develop ideas together. Do not rule out any idea at this stage no matter how simple or unworkable. This is not the time to judge ideas, but to record everything that comes to your mind within the same problem, the goal is quantitative and not qualitative to work out as many ideas as possible.
Encourage non-traditional ideas, hear from your colleagues in the group, develop their ideas and build on them. You can use visual representation (graphics or images) to make ideas easier to understand. Try to tie things together and not think of each part alone.

4-Prototype(prototyping solutions): After filtering and finding the best solutions and ideas, we create the first model (prototype) to solve the problem, which can be further developed according to the result of test stage.

5-Test(testing solutions): test (prototype) to evaluate what works and what doesn't work and if it is accepted by the patient or needs to be modified. Focus in learning and monitoring at this stage.

Design Thinking is iterative, which means you test assumptions then return to the prototype stage or earlier stages and modify it based on results and feedback. Iterate to learn lessons, sooner rather than later, then try again.

I distributed this paper with two languages (Arabic, English) to all participants for more understanding the design thinking methodology processes.

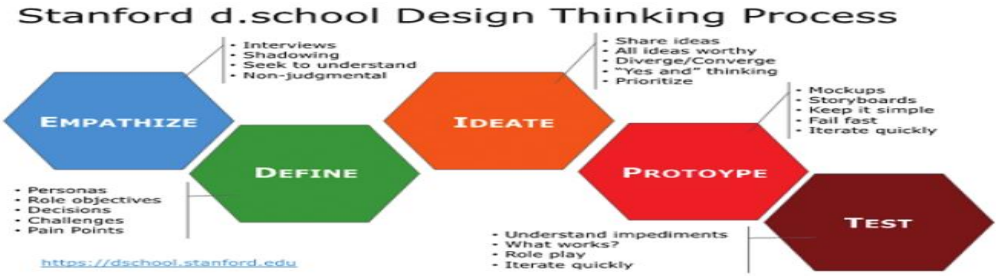


Figure: Design thinking processes

The second part of the session two, Empathy.

Overview

The goal of the second session was to help participants use mapping exercises to gain empathy for dental healthcare patients. In this session, The researcher explained all the processes involved in design thinking and how they can be iterated during the next processes. Then distributed papers to all participants for more understanding the design thinking methodology processes.

The second session, they were randomly assigned to 4 groups. We started the session by elaborating the idea of innovation, in general, and its benefits in growing the organization and improving patient services and staff efficiency. After that explained the top innovation methodologies and then

expanded on and illustrated design thinking methodology, including its definitions, purpose, and processes and how it develops.

To enhance visual learning among the participants, we played a set of videos illustrating all the tools that are used in the design thinking process. We used the (d.school) design thinking processes. This process embodies five principles applied to design thinking, namely empathizing, defining, ideating, prototyping, and testing. Figure 1 shows the five elements.

After providing all the information about the design thinking methodology and its processes, we started applying the first process in the design thinking process, which is empathy. A team that empathise with patients can easily create value for them. This eventually leads to a successful organization.

The exercise focused on WHAT is the Empathize mode, WHY to empathize and HOW to empathize. Empathy is the foundation of human-centred design processes. In our case, it included 1) observation of the patients and their behaviour in the context of their lives; 2) engagement which focuses on interview and interacts with patients; 3) immersion which includes what most of the patient experiences.

Visualisation representation tools

Every activity relevant to the design thinking workshop is visualised using various tools. The tools display a summary of the output and the content of the entire session.

The staff, dentists, and dental assistants were trained to make indirect observation and conduct interviews with the patients. In this session, we used some tools such as Empathy Map, Problem Tree and Journey Mapping

(snake and ladder) as a means to understand and enhance patient experiences.

Empathy map

An empathy map refers to a visualisation tool used to express the details known about a specific type of user (Gibbons, 2014). The tool externalises the knowledge about end-users to help create a mutual understanding of their needs as well as decision making. In the dental care context, teams usually use an empathy map to gain an in-depth understanding of their patients. The team was thus required to visualise patient attitudes and behaviours while in dental clinics. By getting inside the patients' mind, the team could make better treatment decisions that improve patient experiences. See Figure 2

Figure 3: Empathy map

The map shows what the patients say, think, do and feel while in the dental clinic.

The Problem Tree

The Problem Tree usually includes the main problem (trunk), causes of the problem (roots) and the effects (branches). It aims to produce a structural analysis of the leading causes and effects of a problem. In this training, the problem tree was used to help all stakeholders in dentistry establish a real overview of dental care problems and their core causes of the problems from the patient perspectives. Using the problem tree, they dissected questions into different elements. For instance, the tree helped us identify common dental problems like tooth decay, bad breath, dental emergencies (toothaches), mouth stores, periodontal disease, tooth sensitivity, oral cancer and tooth erosion. They

identified the common causes of these problems, including smoking, failure to brush teeth regularly, lack of fluoride, poor oral hygiene, gum disease, dry mouth, diabetes and consumption of sugary foods. What is more, they identified impacts such as hypodontia, cavities, stained teeth, cracked teeth and impacted teeth.

Figure 4: Problem tree for dental problems

Journey mapping

A journey mapping tool helps visualise the process individuals go through so that they realise their goals. In our case, it visualises the process patients go through so that they receive dental treatment. The journey map helps the staff understand patients' motivations, pain points and needs while visiting the clinic. It thus becomes more comfortable to address essential service reforms such as regulatory constraints, patient experience and provider performance (McCarthy et al., 2016).

Figures 4 shows an example of some different maps illustrating a visit to the dental clinic.

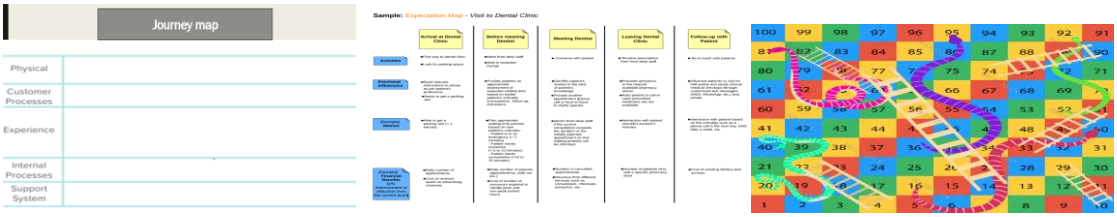


Figure 5: Journey map showing a visit to the dental clinic by the patient

To demonstrate the concept of empathy, all the participants started to walk through the dental centre and put themselves in patients' shoes. They focused more on the patients' feeling in each step than what the patients actually do. All the participants applied this process with each other through role-playing.

In the second day of the session, the participants started to apply empathy in the real world and try to empathize with real patients. They needed to gain insights into empathy and patients' needs and apply the learning acquired into a specific method/system which gives patients what they want with regards to dental services.

The third session of the design thinking workshop

Although there were interactions among all participants, they were unable to identify several problems from the patients. Some of receptionists and dentists claimed that the patients that they talked to and observed in the dental clinics were satisfied with the services.

It was observed that the patients only mentioned a few problems to the receptionists. Some of the problems mentioned include an emergency patient wants to get to the dental clinic quickly yet there is no clinic available during this time, the patient does not wish to pay for the consultation fees, problems in parking and elevator problems.

The trainer asked them to iterate the same process (empathy) and bring as many issues as they can from the patients in the following day.

We started to illustrate the second process, define. We started to explain WHAT is the Define mode, WHY define and HOW to define. The participants discussed and helped each other to identify the core problem (it might not be obvious to identify the problem), compile all relevant details, define the problem and the study objective, and build a collaborative team.

The staff, dentists and dental assistant sat together and defined the challenges and the problems. It was vital that they arrive at a thorough definition after filtering the information resulting from the first step, analysing it objectively, and identifying the problems in a way that leads to an accurate definition.

Identifying Common Themes and insights

The questions that helped the participants to define the problem were:

- What is the exact or real problem?
- How might we redesign our approach to improve patient experience in our clinics?
- What are the existing solutions?

To pass across the define, we used some tools like Question Ladder, blind men and elephant, Context Map and persona development.

Question Ladder

The question leader is a technique used to interview people. You ask a sequence of questions on various elements linked to a specified topic (Lavrakas, 2008). The questions asked in this session focused mostly on what most patients who visit dental clinics value. The interviewer started with simple questions

before asking complex questions. Each simple question was followed by 2-3 follow-up questions.

For instance, the following ladder was used. Simple questions

complex questions

	Is	Did	Can	Will	Would	Might
Who	Who is using the dental clinic at the moment	Who did most patients prefer to address their dental problems	Who can help patients as they seek dental care in clinics?	Who will work with patients during appointments ?	Who would be prepared to work in the dental clinic from the current staff?	Who might solve all the problems most patients present when they visit dental clinics
What	What is patient satisfaction ?	What did the dental clinic previousl y produce?	What can dental staff do to enhance patient experiences	What will the clinical factors in improving patient experiences?	What would I have to do in order to encourage the staff improve dental services?	What might the staff feel about the working environmen t in the clinic?
Wher e	Where is the clinic located?	Where did the staff who work at the clinic come from?	Where can the staff improve?	Where will the dental clinic be in the next 5 years?	Where would the administrator s look for new staff to expand the current workforce?	Where might I find appropriate services?
When	When is the clinic frequently used?	When did the staff know that they needed to improve service delivery?	When can the clinic begin delivering superior services	When will patients feel safe and secure in the clinic?	When would patients agree that there is service improvement ?	When might patients consider using other dental clinics?
Why	Why is this dental clinic suitable?	Why did the previous patients leave this clinic?	Why can the clinic offer affordable services?	Why will patients go to other clinics?	Why would patients visit the dentist regularly?	Why might it be important for the clinic to provide accessible care?
How	How is the clinic treating dental care patients?	How did I treat patients?	How can the dental staff improve patient experiences ?	How will the management deal with patients? Complaints	How would the patient complaints affect the whole clinic	How might the existing staff train new recruits?

Figure 6: The question ladder

Patient persona development

In persona development, a persona refers to a written depiction of the solutions to the mentioned problems in the form of prototypes for the intended users, which are patients. A person thus represents a patient in our case.

Personas were used to provide the participants (as a team) a shared knowledge/understanding of patients with regards to dental clinic capabilities and goals. The details included for each person were persona group (e.g. first-time patient, regular patient), fictional name (e.g. Sara Ahmad), major responsibilities, challenges, sources of information, a quote defining the person, demographics, goals to accomplish, casual photos and what the patient wants from the dental clinic.

On the third day of the training, the participants increased, thus engaging and interacting more with other participants. One explanation for this trend was that more participants found that they need further learning and support in different areas related to addressing the diverse needs of the patients. What is more, the participants in the previous training might refer to other staff members who might be unaware of the training during the initial stages. Enabling the participants to engage with other stakeholders (when performing assigned tasks for submission in the next training session).

The training helped the participants change their patterns of collaboration, which increased the engagement of individuals in groups, other groups finding the need to invite other participants. Participation in the training gave the participants the platform to create social networks and facilitate peer education; further cooperation and invitation of new members was likely.

The training was designed for dental staff members who have already performed several dental procedures (or interact with patients) and were willing to learn new activities and methods to improve their dental practices. Participants had to be active within groups, engaging in several role-plays. The factor that was beneficial to the participants was offering different types of activities and level of experience irrespective of their gender and age. During the training, the participants looked for improved ways of carrying out dental activities and involving other practitioners to enhance the patient experience.

The intervention worked because of several reasons:

i. Proper understanding with regards to specified job roles, skill gaps and current competences.; ii. The skilled team delivering the training. A professional equipped with a comprehensive understanding of design thinking helped to deliver a successful training.; iii. Appropriate training needs identification-it was vital that all dental staff understand why the training on design thinking is essential in the dental practice context.; iv. Proper planning and management helped to realize a successful training intervention.

The fourth session of the design thinking workshop

Overview

The session focused on the ideation process, as highlighted by d. School. Each group were required to present a problem/challenge and recommend an appropriate solution during brainstorming.

Activities

- Reviewing patient issues and concerns as presented by the participants
- Brainstorming methods for solving each problem.

Approach

During this session, there was a significant interaction and cooperation from all participants. The trainer asked the participants to sketch 3-4 problems patient complaint about the current dental practice. Most of them brought the issues that extracted were from the patients. The issues include:

- The patient complaining about the doctor stopping treatment more than once to respond to communications from others and taking a long time in the conversation on the phone
- The doctor taking too much time to examine the patient during the treatment process and lack of organization when setting the appointments with patients.
- The patient coming late and refusing to make another appointment when the basic appointment is delayed
- The doctor and receptionist giving two or more patients appointment at the same time with the same doctor
- The insistence of the patient to be attended to during the appointments of other patients, increase in the number of patients at specific times
- The attendance of many patients without appointments
- Failure to disclose enough details for the doctor to treat the patient and patient dissatisfaction with the cost of the service provided

We started by defining these problems and the frequency of occurrence. All the participants immensely contributed to the discussion on how to define the problems. The participants identified the following view:

- The delay of the patients who fail to enter the dentist's examination office on time
- Patients are not bound by the appointment and the transfer takes place eating into another time
- There are some emergency situations that cannot be avoided, affecting the appointments and sometimes leading to more delays
- The patient's insistence on getting an appointment without entering the payment details of the disclosure fees
- Delay of the patients while attending the clinics
- The inability to adjust the appointments of patients
- Poor time management by the dentist
- Patients who cannot communicate in the English language, especially immigrants from other countries
- Some doctors just think about focusing on the patient being treated and does not think of patients in the waiting room, having appointments
- poor priority management of the Doctor
- failure to handle issues raised by new patients without appointments or late appointments Sometimes the receptionist forgets to confirm to the dentist or the dentist assistant that there is a patient out in the clinic who has waited for a long time

- Weak decision-making among dentists who accept patients who arrive at the clinics late after their appointments, causing delay for the next patient in the list of appointments
- Patient's anxiety and phobia resulting in avoidance of dental care

The researcher explained the third element in the process, which is ideate. In the explanation, I described WHAT the Ideate mode is, WHY we ideate and HOW to ideate. The primary objective was to generate 5 alternatives to test, share the solutions, capture feedback and iterate taking into account the feedback.

In this session, we discussed the ideate process and how to brainstorm, co-create, prioritize ideas based on the findings of the defined problems and identify the target areas that require improvements. The findings revealed that no limitations exist regarding the processes followed to arrive at these ideas in this stage.

For example, during the discussion on ideate process, we encouraged the participants about coming up with as many ideas as possible, using the worst idea method (the crazier and more out of the box), allowing for freedom and expression and accepting all ideas. The purpose of the ideate stage is to encourage participants to put forth their ideas.

There were some questions to help discuss the process effectively. The following questions were useful in the session:

- What can be done to solve the identified problems?
- What do patients need, and how can this be presented to them?
- How can the existing solutions/innovations be changed/adapted/modified to the needs of the patients?

- How can the experience change?
- How can the process/system be more effective/efficient?
- Can current trends be built upon? What are the possibilities?

Solutions

The researcher required participants to generate solutions to the problems they had identified. So, I asked them to suggest 3-5 ways to meet their patients' needs. When asked about what could be done to solve the problems mentioned above, the participants suggested the following:

- Arriving early in the office and preparing files for each patient who has confirmed an appointment
- When taking phone messages and sending messages, the receptionists should consider the date, time and recipient of the message.
- Hire language translators who can assist the clinic deal with patients who do not speak English or Arabic.
- Spend more time listening to the patients' questions and reactions. The dentist also recommends that all staff members should learn more about the patients' worldview and feelings
- Dentists and receptionist should collaborate and monitor follow-up appointments
- When scheduling appointments, the receptionists should note down the reason for the visit, allocate enough time for the whole visit and provide the patient with necessary details regarding the appointment, e.g. date and time.

When asked about what patients need, the participants provided the following suggestions:

- To better understand their diagnosis and specific treatment prediction. The patients who do not understand their diagnosis may feel more anxious. Thus, the dentist should explain the diagnosis made.
- Patients may sometimes have a need for more information on some aspects of oral health. If dentists and dental assistants to do not meet this need, it may result in patient dissatisfaction with services. So, the dental staff should ensure that the patients are better informed as this tendency leads to more satisfaction
- Patients need appropriate treatment. Some pharmaceutical treatments adversely affect their emotional needs. In other causes, radical surgery may affect their appearance needs. So, dentists must administer suitable treatments.

Tools and Methods for Visualization

The tool used to support learning in this session was SCAMPER. SCAMPER is a creative brainstorming method used to enhance knowledge as it helps people thinking outside the box (Hanesova, 2014). The participants used this technique to challenge the current status in dental clinics and explore new solutions and possibilities. The method includes the following elements: (S) substitute, (C) combine, (A) adapt, (M) modify, (P) put to another use, (E) eliminate and (R) reverse. The verbs suggest the changes required to address the exiting processes, products or services. These elements are useful in new idea generation.

Using SCAMPER, the team generated new choices for addressing the problems identified as presented by the patients. The focus of the method was on service and product improvement, not fresh innovation.

Substitute
Combine
Adapt
Modify
Put to another use
Eliminate
Reverse

Activity	New solutions
Substitute	Use Air abrasion method to perform procedures such as chipped teeth repair, tooth fillings and sealants instead of airflow method. Encourage patients to use Air-blast technology for brushing instead of regular toothbrush
Combine	Patients can combine solar-powered electron toothbrush with AirFloss. Combine consultation, billing and treatment activities so that patients do not waste time moving from one office to another.
Adapt	Adapt and focus on one task instead of multitasking while treating patients.
Minimise	Reduce the use of phone and chatting while attending to patients.
Put to other use	Put customer opinions and suggestions boxes in the waiting room
Eliminate	Eliminate the activities that increase waiting time for patients with appointments. Remove the steps in the dental processes which often annoy patients. For instance, the dentist should introduce himself by the first name only instead of using too many titles just for introduction purposes.
Reverse	Reverse the need of the receptionist doing 3 or more procedures at the same time.

The fifth session of the design thinking workshop

In this session, we started to brainstorm and think about how we can use the "clip" in many uses as a starting point. It was a quick exercise meant to make the participants think out of the box.

In this ideate stage, the trainer asked the participants to suggest solutions to common problems that the patients experience. All the participants were interactive and interested in giving their ideas and solutions. Some of the solutions that were proposed are:

- A friendly reception of the patients, doing simple tasks to address their appointments and confirming their appointments to avoid later delays
- Add extra 15 minutes on their specified time/appointments
- Strategically place a board at the reception and highlight the waiting time to inform all patients. For instance, a receptionist proposed that the team writes the following message: "*the waiting time for the patients with appointments will be from 30 to 45 minutes.*"
- Developing a program for the clinic to send and remind the patient of the appointment date, day and time, with a note stating the need for the presence of the patient before the exact time (arrival should be ten minutes earlier). The program should also notify the patient that when he/she delays and does not get to the clinic on time, the appointment will be cancelled. Consequently, the patient will have to reserve another appointment on another date
- When the patient arrives late, the receptionist should ask the doctor to determine if he or she has the ability to receive the patient without interfering with other appointments.
- Increase efficiency in the office and create attention in all dental areas to please the patient in clinic, making their experience enhanced

- Encourage full attention as the dentist interacts with patients within the clinic. Encourage the dentist to establish a friendly relationship with all patients, without favoring or discriminating others
- Giving each patient appropriate consultation and treatment regardless of the number of available patients
- The receptionist needs to welcome all patients warmly, make them feel comfortable, provide all facilities to make the patient comfortable and brief the dentist to provide the best care for the patient and other patients
- In emergency cases, the clinic should allocate specific areas where patients can receive appropriate care or help.
- Provide free internet in the waiting room so that patients can be engaged as their wait for their appointments

Methods and Tools

We used the "ideate" tools, including Lotus blossom, Sense Storming and SCAMPER to demonstrate the ideate phase. All participants engaged in interactive exercises and gave their ideas and corresponding solutions.

Lotus blossom

Lotus blossom is a creative thinking method which helps a team expand its thinking beyond the normal thinking paths (Hanesova, 2014). This visual technique is useful in generating new ideas. The participants used this technique to the organization their thinking and ideas around significant dental care themes.

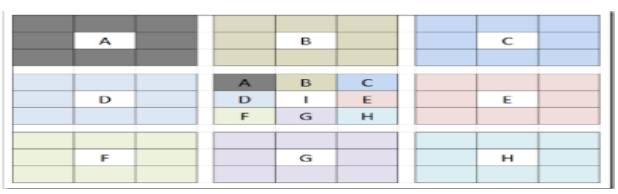


Figure 7: Lotus Blossom

We applied the technique as a means to address various problems mentioned by patients. The problems include poor communication, errors made during treatments, too much time wasted during the appointments, inefficiencies among the staff.

The following question was used to generate new ideas and revised solutions during the session:

- What would I change at the dental clinic to improve patient experience?

The revised suggestions provided by the participants included:

- The treatment process-use appropriate techniques when treating patients to avoid further injuries.
- Smoothen patient consultation to ensure that all patients with appointments are attended to.
- Ensure that all patients access the required care. Handle patients brought to the clinic with emergencies.
- Improve staff communication through education: develop training material for the staff to use and report individual successes and the general progress made towards improving patient satisfaction.
- Implement a service-excellent training program for the staff at all levels. Promote a respectful, helpful and courteous office staff.
- Promote shared decision making. Teach empathic and effective communication-encourage inter-departmental communication so that the staff can optimise workflow and patient experiences.
- Train the receptionists in customer service so that they give a positive impression while interacting with patients.

- Reduce the price of care for the patients who visit the clinic for treatment.
- Seek help from a specialist in case the dental problems presented cannot be handled by the available team.
- Ensure that the nurses, dentists, technicians, dental assistants and managers interact with the receptionists (the frontline staff). As they interact, they learn about what works well, what requires improvement and which strategies they can adopt holistically to make improvements.
- Improve patient communication-provide patients with timely, uncomplicated, practical and friendly information on what they should expect from their dental appointments, hospital stay and follow-up activities. Improve all elements of communication with the patients from the initial contact with the receptionist up to the dentist.

Figure 7 illustrates a scenario indicating the solutions to improve the patient experience using Lotus Blossom.

Figure 7: Lotus Blossom is illustrating new ideas that should generate as solutions to address the problems raised by patients

NOTE: Some of the participants asked me to give them my ideas but I responded to them saying that I am a facilitator in this stage and I have to give them the information, tools and the methods for applying the design thinking processes as a research team decided.

After completing the discussion on ideate stage, the trainer introduced the next phase, which is the prototype. We started off with the following quote: "If a picture is worth a thousand words, a prototype is worth a thousand pictures". The trainer explained the meaning of Prototype mode (WHAT) WHY we prototype and HOW to prototype. As the trainer, I asked the participants to start this phase of design thinking, which involves developing the prototype that will be translated into a product or service.

In our interaction, we mostly focused on rapid prototyping. The initial model, which is based on the implementation of the proposed ideas, is designed to identify the idea that is compatible with the project and an appropriate plan on how to put the idea into practice is implemented. The idea serves as the first form of a solution, which can be applied and tested in general.

Questions are useful in group discussions. The following are some of the questions that helped the participants understand the prototyping concept:

- What needs to be changed to fit the user's needs? ; What works?; What does not work?; What elements can be taken forward?; What are the metrics for success?

Method and Tools

The tools used to improve the participants' understanding of prototyping include role-Playing/Enactments, Concept Sketches and Storyboards.

Role Playing

In the medical setting, Nestel and Tierney (2007) state that scholars frequently use role-play method for learning purposes. In Role Playing, actors change behaviour to assume and act out a role. The learners apply the learnt

content immediately and are asked to assume the decision maker's role; resource allocation, policy making etc.

Role-playing scenario

The participants reported that their dental clinics often struggle with patient handoffs. After engaging in a brainstorming activity, the team areas suggested some improvement areas.

To illustrate the practice, we used index cards. The team wrote the three patient handoff situations, put them in a small box and then members were asked to pull them and various role-playing activities randomly. Each session required a dentist, a financial manager, a receptionist, an observer and a patient. I allowed the patients to select their cases as well as roles. Prior to role-playing, the participants had already learnt about the roles of all dental healthcare staff.

Concept Sketches

Concept sketches are diagrams succinctly annotated with simple sentences which describe the concepts, processes and interrelationships. According to Cheung, Saini and Smith (2016), concept diagrams provide the visible form of different ideas, concepts and thoughts. Having the participants generate their individual concept sketches was a powerful way for them to process design thinking concepts and express them to other colleagues.

The sketch shows the nurse, doctor and dentist with the thermometer, stethoscope, syringes, medicine, a healthy heart, healthy teeth, blood pressure monitor, toothbrush, two medical check-up forms, floss icons, dentist tools

and one dentist chair. Through design thinking, the participants can improve on using these tools to enhance the patient experience.

Storyboards

Storyboards are graphical representations of the way videos unfold. They are used to engage learners in critical thinking, creative thinking and in-depth reflection on various healthcare practices (Lillyman, Gutteridge, & Berridge, 2011).

the scripts used in the session are text-based, storyboards are visual representations. Figure 8 shows a sample of the images used in our storyboards.

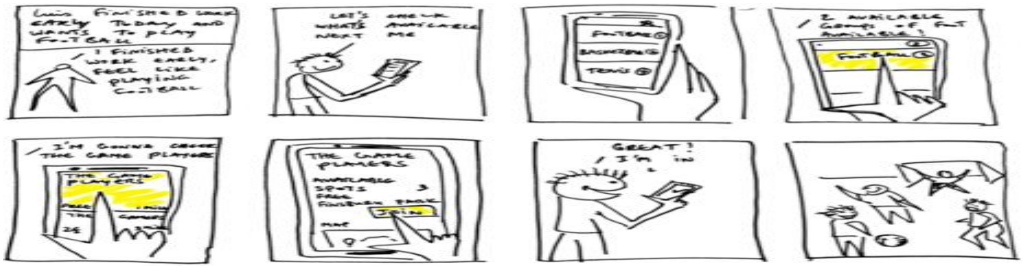


Figure 8: Storyboard sample

The sixth session of the design thinking workshop

Overview

In this session, the participants used simple materials in dental clinics to develop low-fidelity prototypes. The objective was to build the recommended solutions and test them in the form of prototypes. The participants made tangible things for their partners to interact with, e.g. reminder message.

Approach

We started to build the prototype and try to apply it collaboratively. The participants shared their prototype and modified them before finally sharing them with the patients. There were many prototypes of the messages that can be sent to patients to remind them of their appointments. The participants also provided prototypes for the message put in front of the reception for patients to pay attention to it. The following is a sample of the prototype

Dear patient,

Elite's smile specialized medical complex would like to remind you that you have an appointment tomorrow, 15th of April 2019 at 4pm. We look forward to seeing you then. Please note that we no longer accept patients who arrive more than 15 minutes late. If you wish to cancel or rearrange your appointment, please call ??????74 /?????743
Dear patient, your presence on your appointment does not mean that you are going to the doctor directly for reasons beyond our control. We appreciate your cooperation. Thank you.

In the second part of the session, I explained the last stage of design thinking, which is testing. My explanation covered the meaning of the test mode, WHY we test and HOW to test solutions. I then asked the participants to implement the final test, which is followed by the actual implementation. In the implementation, the user accepts the proposed solution. This activity is considered to be an improvement and development of the successive stages.

Design thinking is also based around the concept, learning to “fail fast.” This trend comes from the iterative nature of the design thinking processes. Iteration is the way to identify and evaluate the solution. The product is often presented to the patients, who are left to try the service, so we learned about dealing with problems suggested by a different patient. This way, we detected whether the product or service is easy, and the user has the

option to modify it. This stage marks the first actual experience of the user. So, the product can be known for its effectiveness.

The questions that helped enhance our discussion included:

- What are the goals?; What processes will get us into the goal?; What are the constraints?; What are the current requirements?; What are the future requirements?; What are the guiding principles?; How do we communicate with users?; These prototypes were applied at the same time so that we could test them during the next day.

Methods and Tools

The following tools were used in this session: feedback capture grid, I like, I Wish, What if and Sharing inspiring stories.

Feedback capture grid

The trainer encouraged the participants to share their solutions, test their prototypes and get constructive feedback. Thus, we used the feedback capture grid. The feedback capture grid helps you organize feedback in a structured manner. It is used during product testing to capture the feedback on prototypes and presentations as provided by end users (Dam & Siang, 2019). The team used this tool to get feedback about the progress made by the team and patient's feedback regarding the prototypes. The grid includes what worked, what require improvements, pending questions and new ideas.

I like, I Wish, What if ((IL/IW/WI)) method

According to Dam & Siang (2019), IL/IW/WI tool encourages open feedback.

We used the tool in small groups.

For instance, some of the participants stated the following:

- *I like how our staff members communicate to each other and with **patients***
- *I wish that patients could call the reception desk and cancel or change their appointments instead of causing clashes ones they fail to attend their actual appointments*
- *What if we sent reminders to patients so that they do not forget about their appointments?*

As a group, they shared many thoughts in this session. We had one person in each group capture the feedback. Using their judgement as a group, they decided about the topics that required further discussions.

Likes (+) The receptionists send reminder messages An interactive website with the public (patients) Need for dental assessment confirmed Free Wi-Fi Resources available to ensure the team communicates with each other and patients effectively.	Criticism I am paying for the service so I will enter on my time. There is need to provide professional knowledge regarding dental treatments
Questions (?) The message is too long. Why? Why you did not mention the name in the message? Why I have to wait?	Ideas (!) The message can be shorter Avoid infections following teeth extraction Avoid multitasking while treating patients

The seventh session of the design thinking workshop

In this day, the participants were presented with the feedback provided by patients during the interactions with the staff. For example, a woman came to the clinic for a dental appointment and was expecting to deliver on that day. She found out that the date of appointment was for her daughter and not hers.

The reason for the confusion was that both use the same phone number and are treated in the same clinic.

To address this problem, the participants changed message, indicating the name of the patient in the same message to avoid the confusion. What is more, some of the patients mentioned that the message sent is very long. They recommended that the team compose short messages.

Another feedback provided indicated the need to display messages in the notice board. The board should be located in front of the reception. Patients can read the message and understand the approximately time that they need to enter to the dentist. Some of patients was a bit angry. So, the participants tried to exclude message and come back to the ideate stage to find another solution. They started thinking about another solution, which involved putting free internet in the waiting room instead of positioning the notice board in front of the patients.

In this session I explained the process of iteration and how it is the basis for good design. I asked them to repeat the iterations by going back to the initial stages several times, as well as by repeating them and creating multiple prototypes or experimenting with different forms of brainstorming with multiple combinations. The objective in each iteration was to understand the current product or service state, understand the available solutions (actions) and expected outcomes and make enhanced action decisions.

Regarding to the message in the board which put in front of the reception and some feedback that mentioned from the patients that they pay money for the service, so they want to get the doctor on the time. One of them was a bit angry. So, they try to exclude that message and come back to the ideate process

to find another solution. They started to think about putting the free internet in the waiting room for the next testing instead of the board in front of the patients. In this session I explained the process of itration and how it is the basis of good design. I asked them to repeat them by going back to the initial stages several times, as well as by repeating them by creating multiple prototypes or experimenting with different forms of brainstorming with multiple combinations.

Iteration Process

Design thinking intervention can be achieved by iterations focused on product designs, test with end users and prototypes (Robbins, 2019). The workshop focused on iterative improvements for the current dental clinic services. In each iteration, we looked at how patients experience our dental services now what solutions could we implement to enhance improvements.

We started by examining the patients' current experiences using a journey map. After assessing the experiences, we highlighted the best dental practices, pain points and brainstormed on ideas for improvement (Gray, Brown & Macanufo, 2010). We then made the second expected journey map showing the experiences we were interested in creating. The team started experimenting and testing the proposed solutions.

I did iteration after three weeks from the seventh session. In each iteration, some changes were observed. For instance, receptionists and dentists evolved

to decode patients' health needs and identify the appropriate treatment plan. Together, all participants evolved to interact politely, communicate effectively and administer appropriate treatments.

The main goal of iteration is to exclude things that not important in our algorithm. Iteration started with the prototype and the final test. However, we can start to define the challenge from the first processes in case of need to that. We started to talk about the design thinking processes again, and about the results that we need to improve by returning to the prototype and testing the solution again. One of the solutions that we needed to go back and refine it is the reminder message sent to patients. This exercise was effective during our testing process.

All participants tried to interact with the prototype and refine it by referring to the feedback provided by the patients to launch the last version of this service. The other solution that they wanted to launch was free Internet for the patient. They tried to use different communication companies as a prototype, which was tested. In the end, all patients agreed to use a specific company that would offer the best speed in the region.

On the second day, the participants preferred to talk about the new challenges. The challenges included:

- The patient does not accept the value of service
- Evasion when evaluating the cost of treatment

The participants started to define the problems and generate the solutions until the test process. Some of the revised solutions suggested were:

- The dentist should disclose pertinent information regarding the treatments to the patient for him/her to make a voluntary choice and accept

treatment. The dentist is thus required to engage the patient in his/her dental care. The discussion about informed consent includes the nature of the treatment procedure, relevant risks, uncertainties and benefits, reasonable substitutes for the proposed dental intervention and an assessment of the patient's understanding

- There are various reasons patients avoid treatment. In case the patient evades care because of high costs, the clinic managers should discuss about reducing healthcare costs to ensure accessibility by most patients.
- Some clinics to refer patients to other public hospitals. The problem with this solution is that the practice creates duplicate visits and tests
- Communicate to patients about the repercussions of failing to get the recommended treatment. When patients understand the harm that will befall them if they do not get treatment, they make informed decisions and seek for treatment immediately.

Routinization (scripts and checklists)



Overview

Each dental clinic has its routine and medical team. In this regarded, I conducted 3 days training on using scripts and checklists the first training was for all the staff and the second and the third were separate.

Approach

The clinic staff need to advice patients requiring advice or having questions about their treatment. To demonstrate this practice, we had participants identify card badges (give the photograph, name and occupation of everyone) so that patients could easily identify them. A notice board was placed in the waiting room so that patients could easily find information about the dental clinics' staff, services and treatment costs.

For role playing purposes, each patient was required to be under a consultant's care (the dentist). The dentist's role involved discussing the dental condition of the patient and the appropriate treatment plan. Checklists were used as means to improve patient safety and help physicians better connect with different patients.

Training Sessions

On the first day, I introduced the workshop on using checklists and scripts in dental practice. The main guides employed included talking points, dental set-up considerations and scripts. I used PowerPoint slides to clarify the main aim of using scripts and checklists. To ensure that each participant follows the required routine in a timely manner during exercises, we used a timer. I displayed a visible timer to let the participants know the time taken to carry out each exercise.

The goal of the first session was to give the participants an overview of routinization, which entails using scripts and checklists. I therefore tried role play for simple dentistry scenarios. We arranged the learning space in such a way that participants could easily pair up and form groups when necessary. I divided the participants into four groups.

For instance, to start the session, I used the following kick off message: “Instead of simply describing routinization to you, I want to immediately help you jump in the discussion and experience it. We are going to explain a simple scripting scenario for about 10 minutes. Are you ready? Let us begin.”

On the second day, I focused on the receptionists in their area of interactions. I taught the participants about applying scripts in the reception area while interacting with real patients. The main exercise was for the receptionists to design something meaningful and useful for their patients. They were to begin by gaining empathy. The receptionists interviewed the patients as soon as they arrived at the clinic and recorded some notes.

The most crucial part of designing the checklist is for the receptionist to gain empathy for the patient. One way to achieve this objective is to hold a good conversation with the patient. The receptionist is required to ask the patient relevant question so that the patient clearly state the reason for visiting the clinic. Some of the staff members also used the script to illustrate their daily activities.

The scenario for applying the scripts and checklists with the dental clinic receptionist

To demonstrate the use of scripts, the followed the following routine:

When the patient arrives at the dental clinic, the first task is to ask for assistance from the reception desk. The receptionist should be available and offer any kind of assistance required. Ones the receptionist confirms the appointment details, he/she informs the patient about the room to go to in case there is no other patient being attended to.

In case there are other patients, the current patient must wait in the waiting area to be called later. Delays are likely to occur. However, the receptionist should always inform the patient, providing the reason for the delay. The receptionist should let the patient give his/her special reason to justify why he/she cannot wait e.g. a pregnant mother, almost due, should not wait.

NOTE: the dentist sees each patient in order of appointment time, not arrival.

In the scenario described, we used the following waiting time script:

Upon arrival, the receptionist was required to let the patient confirm the appointment and accept to wait. She began with the following:
"Please, state your name so that I can confirm your appointment."
The patient provided the name and the receptionist confirmed the appointment.
Thereafter, the receptionist informed the patient that the dentist had to attend to 3 patients, whose appointments were earlier.
The receptionist gave the patient a good reason so that he could wait. She said:
"We want to give each one of our patients all help and information that they came here for, without rushing. From time to time, that causes others to wait. The dentist will attend to 3 patients before your turn. Please, be patient with us."
The patient accepted. The receptionist thanked the patient for accepting to wait by saying:
"I really appreciate your patience and understanding."
She constantly updated the patient about the delay, after every 15 minutes. The patients in this case knew that he is not overlooked.
She also gave a personalized apology, using these words:
"Mr. /Mrs. ___Mohammed__, I am sorry that we have not yet called you. I would like you to know that we will let you know when the dentist is ready for you."
The receptionist also explained the cause of the delay. For example, she said:
"Other patients are taking longer than we anticipated. Our team wants to cover all the basics before proceeding to the next patient."
To encourage the patient to wait, she approximated the time the patient was likely to wait. She said:
"I estimate that we will take another __15___ minutes before we are ready for you. I will let you know if anything changes."
To demonstrate the concept of empathy in design thinking, the receptionist was required to empathise with the patient. For instance, she said:
"I know it can be hard to wait when you aren't feeling well, or you have other things you want to do."

On the third day, I used checklists with the dentists and dental assistant. My role was to facilitate the session and help the participants follow the stated routine, apply and confirm checklists while interacting and treating patients.
Routine
During the patient's appointment, the clinical team (comprises of the dental assistant and the dentist) ensures that the patient is engaged in discussions about their treatments. Patients are entitled to clear explanations of their conditions and their treatment choices-potential benefits as well as risks. The team should encourage the patients to ask questions about issues they are uncertain of.
In one of the role play activity, we selected the participants to perform the following activities, which are duties of the dental assistant:

- *Assisting the dentist in treatment procedures*
- *Sterilizing equipment, reviewing medical documents, assisting during examinations, and prepping patients.*
- *Prepping and developing dental x-rays*
- *Maintaining strict sterilization and infection control procedures*
- *Preparing and sterilizing dental instruments*
- *Performing office management tasks*

After performing these activities, the participants provided feedback and report for future reference. The following is an example of a checklist filled by one of the participants who played the role of the dental assistant.
Patient name ___Mohammed Ali
Dental assistant name __Jean Hamdi
Date __16/05/2019___

- ✓ *Get the patient and sit him/her in the operatory*
- ✓ *Patient case presentation: Review the patient's chart and medical history*
- ✓ *Take required x-ray before the dentist arrive*
- ✓ *Help the doctor during treatment*
- ✓ *Fill out the form for treatment progress and secure the dentist's signature*
- ✓ *Fill out the routing slip and indicate all procedures that have been performed, any necessary prescriptions and the subsequent visit*
- ✓ *Take the patient's chart, lab slip and routing slip to the finance officer before discharging the patient from the chair*
- ✓ *Discharge the patient from the chair. Escort him/her to the finance officer for checkout*
- ✓ *Clean the operatory ones the patient is discharged*
- ✓ *Prepare the operatory room for the incoming patient*
- ✓ *Keep an inventory of all supply materials. Write down any supplies required*
- ✓ *Sterilize all dental instruments*
- ✓ *File the x-rays produced in patient's charts*
- ✓ *Wash the lab coat, dry it and then hang it as required*

NOTE: ✓on the checklist means that the dental assistant performed the task and completed it.
Signature __J. H.___ Date _16/5/2019____

Essential Elements of the Workshop

End users (patients)-patients were indirectly involved in the process during the implementation stage. We were designing the design thinking process aimed at improving patient experiences. Thus, we had to keep them in mind. Patients provided feedback about the prototypes that were developed in the session. All the participants who attended the workshop were thus required to understand, empathise, test solutions and experience prototypes from the patients' perspectives.

Process: It was essential for the participants to adhere to the d. school design thinking process. This process was adopted to ensure that dental practitioners channel their creativity into addressing common problems patients often present as they visit the dental clinics.

Time: In each design thinking phase, the participants were given adequate time for role playing, with specific deliverables. The time element helps the workshop progress effectively, with the right speed.

Team: mixed participants collaborated and complimented each, taking into account different disciplines such as management, administration, nursing and dentistry. The team viewed problems in dental care from multiple viewpoints, which enabled them embrace holistic ideas as suitable solutions.

Space: We did not limit the workshop to whiteboards and charts. We used various visualisation materials to express different ideas. The tools included journey maps, question ladder, problem tree, persona development and empathy map. To touch and feel the proposed ideas and solutions, all participants were given the opportunity to build prototypes.

Feedback: It was essential that the participants present their solutions, get feedback, learn from it and repeat the solutions to make improvements. The solutions were thus derived through an iterative process.

Chapter 5 Data Analysis and Results

Qualitative and Quantitative Data Analysis

Quantitative data were analysed using SPSS software (t-test). Survey responses were used to test the hypotheses formulated. Survey findings are interpreted quantitatively. Qualitative data were analysed utilising thematic analysis technique. Coding was done to identify themes and patterns.

Table 1: ***Demographics***

		Gender	
		Frequency	Percent
Valid	Male	751	51%
	Female	797	49%
	Total	1548	100%
		Age	
	19-25 years	302	19.51%
	26-40 years	803	51.87%
	41-54 years	416	26.87%
	55 plus	27	1.74%
	Total	1548	100%
		You are here for	
	Your Treatment	1231	79.52%
	your child's treatment	317	20.48%
	Total	1548	100%
		Your nationality	
	Saudi	1351	88.82%
	Expatriate	170	10.98%
	Other	3	0.19%
	Total	1548	100%
		Marital status	
	Single	300	19.38%
	Married	895	57.82%
	Divorced	252	16.28%
	Widow	101	6.52%
	Total	1548	100%
		Your current occupation	
	Unemployed	323	20.87%
	Government Employed	704	45.48%

	Non-Government employed	429	27.71%
	Student	82	5.30%
	Other (please specify)	10	.65%
	Total	1548	100%
		Annual Family Income	
	less than SAR 75000	88	5.68%
	SAR 75000 to SAR 150000	47	3.04%
	SAR 150001 to SAR 262500	57	3.68%
	SAR 262501 to SAR 375000	66	4.26%
	More than 375000	65	4.20%
	I would rather not say	2335	79.13%
	Total	1548	100%
		Frequency of visits	
	First visit	187	12.08%
	subsequent visit	1361	87.92%
	Total	1548	100%

The above Table 1 illustrates that the gender, age, nationality, marital status, occupation, income level and frequency of visit of the respondents. According to results, there are approximately 49% are male participants and 51% are female are participated in this current study. Statistics also stated that approximately 19.51% of respondents are aged from 19-25 years, 51.87% are respondents age from 26-40 years, 26.87% age is 41-54 years, and 1.74% of respondents age is above 55 years. Results state that 79.52% of respondents visited the dental clinic for their treatment and conversely, 20.48% of respondents visited the dental clinic for child's treatment. The resulting state that 88.82% of respondents are Saudi national, 10.98% are expatriate, and 0.19% are other respondents participated in this survey. The statistics illustrate that 19.38% of respondents are single, 57.82% are married respondents, 16.28% are divorced, and 6.52% is a widow in this current article participated in the survey. The results explain that the occupation of the respondents. The statistics show that 20.78% are unemployed respondents, 45.48% are Govt. Employed

27.71% are Non-govt. Employed, 5.30% are student d, and .65% are other are participated in this survey. The above analysis shows that there is 5.68% of the respondent's income is < 75000, 3.04% respondent's income is between SAR 75000 to SAR 150000, 3.68% respondent's income is between SAR 150001 to SAR 262500, 4.26% respondent's income is SAR 262501 to SAR 375000, 4.20% more than 375000 and the 79.13% of peoples are not preferring to say about income level. The analysis illustrates that 12.08% of peoples visited the first time in this dental clinic, and 87.92% is a subsequent visit to this dental clinic.

Table 2: ***Experienced of Visitors***

Where did you first hear about this dental clinic			
		Frequency	Percent
Valid	Radio/newspaper	4	0.26%
	Word of mouth	220	14.21%
	Internet/google	173	11.18%
	Building location	633	40.89%
	Social media	513	33.41%
	Other (please specify)	5	0.32%
	Total	1548	100%
How often have you missed your appointments at this clinic?			
	Never	237	15.31%
	Less than 10% of the time	320	20.67%
	10-20% of the time	296	19.12%
	21-30% of the time	439	28.36%
	31-50% of the time	223	14.41%
	More than 50 % of the time	33	2.13%
	Total	1548	100%
How was your experience in the last visit you had attended these clinics?			
	Excellent	186	12.02%
	Good	267	17.25%
	Fair	579	37.40%
	Poor	366	23.64%
	Terrible	19	1.23%
	This is the First visit	131	8.46%
	Total	1548	100%
Was it easy to find the location of the clinic?			

	Yes	441	28.49%
	Somewhat easy	705	45.54%
	No	402	25.97%
	Total	1548	100%
Was the waiting time to get to the dentist's clinic a reasonable?			
	Yes	45.61%	706
	No	64.39%	842
	Total	100%	1548
How long did you have to wait in the clinic's waiting room before seeing the dentist?			
	Less than 15 minutes	402	25.97%
	15-30 minutes	380	24.55%
	30-45 minutes	578	37.34%
	More than 45 minutes	188	12.14%
	Total	1548	100%

The above Table 2 illustrates that the where respondents hear about the clinic. The results show that the 40.89% hear from the building location, 0.26% hear from the Radio or newspaper, 14.21% are heard from word of mouth, 11.18% hear from the internet or google, 33.41% hear from the social media, and the 0.32% hear from the other sources. The analysis also shows that 15.31% of respondents never missed appointments at this clinic. There are 20.67% respondents are missed appointment less than 10 % of the time, there are 19.12% participants missed appointment 10-20 % of the time time, 28.36% of respondents missed appointment 21-30 % time. There are14.41% participants are missed appointments 31- 50 % of the time and 2.13% respondents missed appointment more than 50 % of the time. The result illustrates that the 12.02% of respondents have an excellent experience when visited this clinic last time. According to statistics there are 17.25% respondents have a good experience, 37.40% respondents have the fair experience, 23.64% respondents have a poor experience, 1.23% participants have a terrible experience, and 8.46% participants visited the first time in this clinic. The statistics show that the 28.49% peoples easy to find the location of the clinic and 45.54% state that the

somewhat easy to find the location and 25.97% stated that it is difficult to find the location of the clinic. The analysis also demonstrates that 45.61% of participants stated that the waiting time is reasonable to get the dentists. Conversely, 64.39% of participants stated that the waiting time is not reasonable to get the dentists. The statistics show that the 25.97% participants wait < 15 min for the dentist, 24.55% wait 15-30 minutes, 37.34% wait for 30-45 minutes, 12.14% respondents wait > 45 minutes for the dentist.

Quantitative Analysis (Staff Survey)

Design Thinking (DT), Routine (R), Filling out the survey (stage).

Table (1). "Pre-Training (DT) stage-1, and Post-Training (DT) stage-2 (stage-2)"

Variable		N	Mean	Std. Deviation	t	Sig. (2tailed)
Problem-solving skills	Pre-Training (DT) stage 1	21.00	3.65	0.82	2.03	0.05
	Post-Training (DT) stage 2	16.00	4.16	0.67		
Behavior	Pre-Training (DT) stage 1	21.00	2.68	0.62	2.46	0.02
	Post-Training (DT) stage 2	16.00	3.27	0.86		
Team dynamics	Pre-Training (DT) stage 1	21.00	3.39	0.91	2.41	0.02
	Post-Training (DT) stage 2	16.00	3.99	0.49		
Challenging	Pre-Training (DT) stage 1	21.00	3.37	0.87	2.29	0.03
	Post-Training (DT) stage 2	16.00	3.95	0.59		
Psychological ownership	Pre-Training (DT) stage 1	21.00	3.56	0.68	2.19	0.04
	Post-Training (DT) stage 2	16.00	3.98	0.39		
Empathy	Pre-Training (DT) stage 1	21.00	3.11	0.46	1.43	0.16
	Post-Training (DT) stage 2	16.00	2.85	0.67		
Perspective taking	Pre-Training (DT) stage 1	21.00	3.42	0.86	2.11	0.04

	Post-Training (DT) stage 2	16.00	3.98	0.74		
creative confidence	Pre-Training (DT) stage 1	21.00	3.16	0.73	1.87	0.07
	Post-Training (DT) stage 2	16.00	3.65	0.89		

P value is significant at **≤0 .05**

1- P-value is significant at (0.05), and its value is (0.05), which indicates a statistically significant difference between the mean responses of the study participants on the axis of Problem-solving skills in Pre-training (DT) stage-1; in which they did not receive any training, compared to Post-Training (DT) stage-2; in which they received Design Thinking workshop. The mean score for the Pre-intervention stage-1 was (3.65 out of 5), while the mean score for the Post-intervention stage-2 was (4.16 out of 5). Thus, we can see an increase in the Problem-solving skills in Post-intervention stage 2, in which the subjects received the Design Thinking training.

2- P-value is significant at (0.05), and its value is (0.02), which indicates a statistically significant difference between the mean responses of the study participants on the axis of Behavior in Pre-intervention (DT) stage-1; in which they did not receive any training, compared to Post-intervention (DT) stage-2; in which they received Design Thinking training. The mean score for the Pre-Training stage 1 was (2.68 out of 5), while the mean score for the Post-Training stage 2 was (3.27 out of 5). Thus, we can see an increase in the behavior level in Post-Training stage 2, in which the subjects received the Design Thinking workshop.

3- P-value is significant at (0.05), and its value is (0.02), which indicates a statistically significant difference between the mean responses of the

study participants on the axis of Team dynamics in Pre-intervention (DT) stage-1; in which they did not receive any training, compared to Post-intervention (DT) stage-2; in which they received Design Thinking workshop. The mean score for the Pre-Training stage 1 was (3.39 out of 5), while the mean score for the Post-Training stage 2 was (3.99 out of 5). Thus, we can see an increase in the Team dynamics level in Post-Training stage 2, in which the subjects received the Design Thinking training.

4- P-value is significant at (0.05), and its value is (0.03), which indicates a statistically significant difference between the mean responses of the study participants on the axis of Challenging in Pre-training (DT) stage-1; in which they did not receive any training, compared to Post-Training (DT) stage-2; in which they received Design Thinking workshop. The mean score for the Pre-Training stage was (3.37 out of 5), while the mean score for the Post-Training stage was (3.95 out of 5). Thus, we can see an increase in the Challenging level in Post-Training stage-2, in which the subjects received the Design Thinking workshop.

5- P-value is significant at (0.05), and its value is (0.04), which indicates a statistically significant difference between the mean responses of t the study participants on the axis of Psychological ownership in Pre-training (DT) stage-1; in which they did not receive any training, compared to Post-Training (DT) stage-2; in which they received Design Thinking workshop. The mean score for the Pre-Training stage was (3.56 out of 5), while the mean score for the Post-Training stage was (3.98 out of 5). Thus, we can see an increase in the Psychological ownership level in

Post-Training stage 2, in which the subjects received the Design Thinking Intervention.

6- P-value is significant at (0.05), and its value is (0.16), which does not indicate a statistically significant difference between the mean responses of the research participants on the axis of Empathy in Pre-training (DT) stage-1; in which they did not receive any training, compared to Post-Training (DT) stage-2; in which they received the Design Thinking workshop. The mean score for the Pre-Training stage 1 was (3.11 out of 5), while the mean score for the Post-Training stage 2 was (2.85 out of 5). However, these differences did not reach the level of statistical significance.

7- P-value is significant at (0.05), and its value is (0.04), which indicates a statistically significant difference between the mean responses of the study participants on the axis of Perspective-taking in Pre-training (DT) stage-1; in which they did not receive any training, compared to Post-Training (DT) stage-2; after receiving Design Thinking workshop. The mean score for the Pre-Training stage 1 was (3.42 out of 5), while the mean score for the Post-Training stage 3 was (3.98 out of 5). Thus, we can see an increase in the Perspective-taking a level in Post-Training stage-2, in which the subjects received the Design Thinking training.

8- P-value is significant at (0.05), and its value is (0.07), which indicates a statistically significant difference between the mean responses of the study participants on the axis of creative confidence in Pre-training (DT) stage-1; in which they did not receive any training, compared to Post-Training (DT) stage-2; receiving Design Thinking workshop. The mean

score for the Pre-Training stage 1 was (3.16 out of 5), while the mean score for the Post-Training stage 2 was (3.65 out of 5). However, these differences did not reach the level of statistical significance.

Table (5). Pre-Training (DT) Stage-1 and Post-Training (R) Stage-4.

Variable		N	Mean	Std. Deviation	t	Sig. (2-tailed)
Problem-solving skills	Pre-Training (DT) stage 1	21.00	3.65	0.82	4.33	0.00
	Post-Training (R) stage 4	21.00	4.59	0.56		
Behavior	Pre-Training (DT) stage 1	21.00	2.68	0.62	4.23	0.00
	Post-Training (R) stage 4	21.00	3.51	0.66		
Team dynamics	Pre-Training (DT) stage 1	21.00	3.39	0.91	3.40	0.00
	Post-Training (R) stage 4	21.00	4.15	0.49		
Challenging	Pre-Training (DT) stage 1	21.00	3.37	0.87	4.07	0.00
	Post-Training (R) stage 4	21.00	4.35	0.68		
Psychological ownership	Pre-Training (DT) stage 1	21.00	3.56	0.68	2.46	0.02
	Post-Training (R) stage 4	21.00	4.00	0.45		
Empathy	Pre-Training (DT) stage 1	21.00	3.11	0.46	0.03	0.97
	Post-Training (R) stage 4	21.00	3.11	0.43		
Perspective taking	Pre-Training (DT) stage 1	21.00	3.42	0.86	3.87	0.00
	Post-Training (R) stage 4	21.00	4.39	0.77		
creative confidence	Pre-Training (DT) stage 1	21.00	3.16	0.73	4.23	0.00
	Post-Training (R) stage 4	21.00	4.14	0.77		

1- P-value is significant at (0.05), and its value is (0.01), which indicates a statistically significant difference between the mean responses of the study participants on the axis of Problem-solving skills in Pre-training (DT) stage-1; in which they did not receive any training, compared to

Post-Training (DT) stage-4; in which they received Routine, scripts and checklists training. The mean score for the Pre-Training stage-1 was (3.65 out of 5), while the mean score for the Post-Training stage 4 was (4.59 out of 5). Thus, we can see an increase in the Problem-solving skills in Post-Training stage 4, in which the subjects received Routine, scripts and checklists training.

2- P-value is significant at (0.05), and its value is (0.01), which indicates a statistically significant difference between the mean responses of the study participants on the axis of Behavior in Pre-training (DT) stage-1; in which they did not receive any training, compared to Post-Training (DT) stage-4; in which they received Routine, scripts and checklists training. The mean score for the Pre-Training stage was (2.68 out of 5), while the mean score for the Post-Training stage 4 was (3.51 out of 5). Thus, we can see an increase in the Behavior in Post-Training stage-4, in which the subjects received Routine, scripts and checklists training.

3- P-value is significant at (0.05), and its value is (0.01), which indicates a statistically significant difference between the mean responses of the study participants on the axis of Team dynamics in Pre-training (DT) stage-1; in which they did not receive any training, compared to Post-Training (DT) stage-4; in which they received Routine, scripts and checklists training. The mean score for the Pre-Training stage was (3.39 out of 5), while the mean score for the Post-Training stage 4 was (4.15 out of 5). Thus, we can see an increase in the Team dynamics in Post-Training stage-4, in which the subjects received Routine, scripts and checklists training.

4- P-value is significant at (0.05), and its value is (0.01), which indicates a statistically significant difference between the mean responses of the study participants on the axis of Challenging in Pre-training (DT) stage-1; in which they did not receive any training, compared to Post-Training (DT) stage-4; in which they received Routine, scripts and checklists training. The mean score for the Pre-Training stage was (3.37 out of 5), while the mean score for the Post-Training stage 4 was (4.35 out of 5). Thus, we can see an increase in the Challenging in Post-Training stage-4, in which the subjects received Routine, scripts and checklists training.

5- P-value is significant at (0.05), and its value is (0.02), which indicates a statistically significant difference between the mean responses of the study participants on the axis of Psychological ownership in Pre-training (DT) stage-1; in which they did not receive any training, compared to Post-Training (DT) stage-4; in which they received Routine, scripts and checklists training. The mean score for the Pre-Training stage was (3.56 out of 5), while the mean score for the Post-Training stage 4 was (4.00 out of 5). Thus, we can see an increase in the Psychological ownership in Post-Training stage-4, in which the subjects received Routine, scripts and checklists training.

6- P-value is not significant at (0.05), and its value is (0.97), which does not indicate a statistically significant difference between the mean responses of the study participants on the axis of Empathy in Pre-training (DT) stage-1; in which they did not receive any training, compared to Post-Training (DT) stage-4; in which they received Routine, scripts and checklists training. The mean score for the Pre-

Training stage was (3.11 out of 5), while the mean score for the Post-Training stage 4 was (3.11 out of 5); in which the subjects received Routine, scripts and checklists training.

7- P-value is significant at (0.05), and its value is (0.01), which indicates a statistically significant difference between the mean responses of the study participants on the axis of Perspective taking in Pre-training (DT) stage-1; in which they did not receive any training, compared to Post-Training (DT) stage-4; in which they received Routine, scripts and checklists training. The mean score for the Pre-Training stage was (3.42 out of 5), while the mean score for the Post-Training stage 4 was (4.39 out of 5). Thus, we can see an increase in the Perspective taking in Post-Training stage 4, in which the subjects received Routine, scripts and checklists training.

8- P-value is significant at (0.05), and its value is (0.01), which indicates a statistically significant difference between the mean responses of the study participants on the axis of Creative confidence in Pre-training (DT) stage-1; in which they did not receive any training, compared to Post-Training (DT) stage-4; in which they received Routine, scripts and checklists training. The mean score for the Pre-Training stage was (3.16 out of 5), while the mean score for the Post-Training stage 4 was (4.14 out of 5). Thus, we can see an increase in the Creative confidence in Post-Training stage 4, in which the subjects received Routine, scripts and checklists training.

Data Analysis (Patients Survey)

Table (1). Pre-Training (DT) group 1 and Post-Training (DT) group 2

Questions	Pre-Training (DT)					Post-Training (DT)					t-test	
	n	mean	sd	min	max	n	mean	sd	min	max	t	p.val
Q3.1 How would you rate your experience with the reception staff?	721	2.62	0.81	1	5	293	3.20	0.79	1	5	10.38	0.00
Q3.1_1 The reception staff are knowledgeable	721	2.52	0.86	1	5	293	3.07	0.81	1	5	9.37	0.00
Q3.1_2 The reception staff are Taking the enough time with me	721	2.56	0.87	1	5	293	3.16	0.83	1	5	10.09	0.00
Q3.1_3 The reception staff are friendly towards me	721	2.63	0.89	1	5	293	3.28	0.83	1	5	10.68	0.00
Q3.1_4 The staff communicate well with me	721	2.63	0.89	1	5	293	3.25	0.89	1	5	10.03	0.00
Q3.1_5 The reception staff easily book an appointment that is suitable for me	721	2.66	0.89	1	5	293	3.23	0.89	1	5	9.26	0.00
Q3.1_6 The reception staff are	721	2.74	0.88	1	5	293	3.29	0.89	1	5	9.00	0.00

Questions	Pre-Training (DT)					Post-Training (DT)					t-test	
	n	mean	sd	min	max	n	mean	sd	min	max	t	p.val
respectful with me Q3.1_7 The staff answer my queries	721	2.61	0.90	1	5	293	3.12	0.87	1	5	8.24	0.00
Q4.1 How would you rate your experience with the dentist and dental assistant?	721	2.58	0.74	1	5	293	3.18	0.72	1	5	11.79	0.00
Q4.1_1 The dentist was respectful towards me	721	2.79	0.86	1	5	293	3.31	0.81	1	5	8.92	0.00
Q4.1_2 The health issue in my teeth was properly treated	721	2.52	0.91	1	5	293	3.19	0.85	1	5	10.88	0.00
Q4.1_3 The dentist communicates well	721	2.53	0.91	1	5	293	3.19	0.88	1	5	10.55	0.00
Q4.1_4 Instruments are properly sterilized	721	2.49	0.89	1	5	293	3.15	0.86	1	5	10.93	0.00
Q4.1_5 The cost is reasonable	721	2.40	0.85	1	5	293	3.13	0.84	1	5	12.32	0.00
Q4.1_6 During my treatment	721	2.49	0.89	1	5	293	3.18	0.85	1	5	11.26	0.00

Questions	Pre-Training (DT)					Post-Training (DT)					t-test	
	n	mean	sd	min	max	n	mean	sd	min	max	t	p.val
the pain was adequately controlled												
Q4.1_7 Dentist is skilled	721	2.57	0.90	1	5	293	3.19	0.85	1	5	10.02	0.00
Q4.1_8 The instructions given to me by dentist were useful in keeping my teeth healthy	721	2.66	0.87	1	5	293	3.22	0.80	1	5	9.54	0.00
Q4.1_9 The dental assistant was respectful towards me	721	2.74	0.87	1	5	293	3.24	0.84	1	5	8.37	0.00
Q4.1_10 The dental assistant responded well when I needed any information about my treatment	721	2.69	0.88	1	5	293	3.20	0.82	1	5	8.51	0.00
Q4.1_11 The dentist and dental assistant were helping me overcome	721	2.63	0.87	1	5	293	3.24	0.79	1	5	10.30	0.00

Questions	Pre-Training (DT)					Post-Training (DT)					t-test	
	n	mean	sd	min	max	n	mean	sd	min	max	t	p.val
my worries												
Q4.1_12 The dentist needed to do more to reduce your teeth pain	721	2.49	0.89	1	5	293	2.93	0.91	1	5	7.06	0.00
Q4.1_13 The dentist is taking the enough time with me	721	2.53	0.88	1	5	293	3.18	0.86	1	5	10.75	0.00
Q5.1 How would you rate your experience with the physical facilities of the clinic?	721	2.66	0.79	1	5	293	3.15	0.82	1	5	8.88	0.00
Q5.1_1 Parking facility is available	721	2.32	0.81	1	5	293	2.89	0.88	1	5	9.96	0.00
Q5.1_2 Waiting room is comfortable	721	2.53	0.86	1	5	293	3.10	0.89	1	5	9.33	0.00
Q5.1_3 Waiting room is clean	721	2.57	0.91	1	5	293	3.05	0.93	1	5	7.54	0.00
Q5.1_4 Proper care is given to clinic cleanliness	721	2.70	0.91	1	5	293	3.10	0.92	1	5	6.31	0.00
Q5.1_5 The clinic opening	721	2.90	0.92	1	5	293	3.31	0.87	1	5	6.57	0.00

Questions	Pre-Training (DT)					Post-Training (DT)					t-test	
	n	mean	sd	min	max	n	mean	sd	min	max	t	p.val
hours are suitable												
Q5.1_6 The dentist's clinic is very modern	721	2.81	0.97	1	5	293	3.29	0.88	1	5	7.23	0.00
Q5.1_7 Good system of ventilation	721	2.80	0.97	1	5	293	3.26	0.86	1	5	7.04	0.00
Q6.1 How would you rate your experience in this complex in General	721	2.52	0.85	1	5	293	3.23	0.87	1	5	11.85	0.00
Q6.1_1 Overall your treatment at this clinic made you happy	721	2.50	0.91	1	5	293	3.25	0.87	1	5	12.02	0.00
Q6.1_2 You will recommend this clinic to your family and friends	721	2.50	0.89	1	5	293	3.24	0.91	1	5	11.81	0.00
Q6.1_3 You are in a better health condition now	721	2.57	0.87	1	5	293	3.24	0.92	1	5	10.97	0.00
Q6.1_4 You are planning to return to this clinic	721	2.52	0.87	1	5	293	3.20	0.89	1	5	11.17	0.00

Questions	Pre-Training (DT)					Post-Training (DT)					t-test	
	n	mean	sd	min	max	n	mean	sd	min	max	t	p.val
Q6.1_5 Your expectations have been met	721	2.51	0.87	1	5	293	3.20	0.87	1	5	11.40	0.00

1- P-value is significant at (0.05), and its value is (0.01), which indicates a statistically significant difference between the mean response of the research subjects on the axis of Staff Attributes in Pre-training (DT) group-1; in which they did not receive any training, compared to Post-Training (DT) group-2; in which they received Design Thinking training. The mean scores for the Pre-Training group were (2.62 out of 5), while the mean scores for the Post-Training group were (3.20 out of 5). Thus, we can see an increase in the patients' agreement on Staff Attributes in Post-Training group 2, in which the subjects received the Design Thinking Training.

2- P-value is significant at (0.05), and its value is (0.01), which indicates a statistically significant difference between the mean response of the research subjects on the axis of Dentist Initiatives in Pre-training (DT) group-1; in which they did not receive any training, compared to Post-Training (DT) group-2; in which they received Design Thinking training. The mean scores for the Pre-Training group were (2.58 out of 5), while the mean scores for the Post-Training group were (3.18 out of 5). Thus, we can see an increase in the patients' agreement on Dentist Initiatives in Post-Training group 2, in which the subjects received the Design Thinking Training.

3- P-value is significant at (0.05), and its value is (0.01), which indicates a statistically significant difference between the mean response of the research subjects on the axis of Physical Facilities in Pre-training (DT) group-1; in which

they did not receive any training, compared to Post-Training (DT) group-2; in which they received Design Thinking training. The mean scores for the Pre-Training group were (2.66 out of 5), while the mean scores for the Post-Training group were (3.15 out of 5). Thus, we can see an increase in the patients' agreement on Physical Facilities in Post-Training group 2, in which the subjects received the Design Thinking Training.

4- P-value is significant at (0.05), and its value is (0.01), which indicates a statistically significant difference between the mean response of the research subjects on the axis of Patient Experience in General in Pre-training (DT) group-1; in which they did not receive any training, compared to Post-Training (DT) group-2; in which they received Design Thinking training. The mean scores for the Pre-Training group were (2.52 out of 5), while the mean scores for the Post-Training group were (3.23 out of 5). Thus, we can see an increase in the patients' agreement on Patient Experience in General in Post-Training group 2, in which the subjects received the Design Thinking Training.

Table (2). Pre-Training (DT) group 1 and Post-Training (R) group 3

Questions	**Pre-Training (DT)**					**Post-Training (R)**					**t-test**	
	n	**mean**	**sd**	**min**	**max**	**n**	**mean**	**sd**	**min**	**max**	**t**	**p.val**
Q3.1 How would you rate your experience with the reception staff? (1:strongly disagree, …, 5: strongly agree)	721	2.62	0.81	1	5	164	3.45	1.01	1	5	11.18	0.00
Q3.1_1 The reception staff are	721	2.52	0.86	1	5	164	3.40	1.06	1	5	11.33	0.00

Questions	Pre-Training (DT)					Post-Training (R)					t-test	
	n	mean	sd	min	max	n	mean	sd	min	max	t	p.val
knowledgeable												
Q3.1_2 The reception staff are Taking the enough time with me	721	2.56	0.87	1	5	164	3.45	1.03	1	5	11.34	0.00
Q3.1_3 The reception staff are friendly towards me	721	2.63	0.89	1	5	164	3.46	1.06	1	5	10.34	0.00
Q3.1_4 The staff communicate well with me	721	2.63	0.89	1	5	164	3.48	1.09	1	5	10.55	0.00
Q3.1_5 The reception staff easily book an appointment that is suitable for me	721	2.66	0.89	1	5	164	3.48	1.05	1	5	10.33	0.00
Q3.1_6 The reception staff are respectful with me	721	2.74	0.88	1	5	164	3.45	1.06	1	5	8.85	0.00
Q3.1_7 The staff answer my queries	721	2.61	0.90	1	5	164	3.40	1.02	1	5	9.91	0.00
Q4.1 How would you rate your experience with the dentist and dental assistant? (1:strongly disagree, …, 5: strongly agree)	721	2.58	0.74	1	5	164	3.30	0.84	1	5	11.02	0.00
Q4.1_1 The dentist was respectful towards me	721	2.79	0.86	1	5	164	3.35	0.96	1	5	7.30	0.00
Q4.1_2 The health issue in my teeth was properly treated	721	2.52	0.91	1	5	164	3.33	0.90	1	5	10.27	0.00

Questions	Pre-Training (DT)					Post-Training (R)					t-test	
	n	mean	sd	min	max	n	mean	sd	min	max	t	p.val
Q4.1_3 The dentist communicates well	721	2.53	0.91	1	5	164	3.30	0.90	1	5	9.89	0.00
Q4.1_4 Instruments are properly sterilized	721	2.49	0.89	1	5	164	3.29	0.91	1	5	10.42	0.00
Q4.1_5 The cost is reasonable	721	2.40	0.85	1	5	164	3.31	0.88	1	5	12.30	0.00
Q4.1_6 During my treatment the pain was adequately controlled	721	2.49	0.89	1	5	164	3.32	0.88	1	5	10.68	0.00
Q4.1_7 Dentist is skilled	721	2.57	0.90	1	5	164	3.32	0.92	1	5	9.59	0.00
Q4.1_8 The instructions given to me by dentist were useful in keeping my teeth healthy	721	2.66	0.87	1	5	164	3.35	0.94	1	5	9.12	0.00
Q4.1_9 The dental assistant was respectful towards me	721	2.74	0.87	1	5	164	3.34	0.96	1	5	7.71	0.00
Q4.1_10 The dental assistant responded well when I needed any information about my treatment	721	2.69	0.88	1	5	164	3.32	0.91	1	5	8.23	0.00
Q4.1_11 The dentist and dental assistant were helping me overcome my worries	721	2.63	0.87	1	5	164	3.33	0.93	1	5	9.17	0.00
Q4.1_12 The dentist needed to do more to	721	2.49	0.89	1	5	164	3.02	0.93	1	5	6.88	0.00

Questions	Pre-Training (DT)					Post-Training (R)					t-test	
	n	mean	sd	min	max	n	mean	sd	min	max	t	p.val
reduce your teeth pain												
Q4.1_13 The dentist is taking the enough time with me	721	2.53	0.88	1	5	164	3.36	0.92	1	5	10.82	0.00
Q5.1 How would you rate your experience with the physical facilities of the clinic? (1:strongly disagree, …, 5: strongly agree)	721	2.66	0.79	1	5	164	3.21	1.00	1	5	7.70	0.00
Q5.1_1 Parking facility is available	721	2.32	0.81	1	5	164	3.07	1.01	1	5	10.29	0.00
Q5.1_2 Waiting room is comfortable	721	2.53	0.86	1	5	164	3.22	1.01	1	5	8.91	0.00
Q5.1_3 Waiting room is clean	721	2.57	0.91	1	5	164	3.21	1.03	1	5	7.98	0.00
Q5.1_4 Proper care is given to clinic cleanliness	721	2.70	0.91	1	5	164	3.26	1.00	1	5	6.98	0.00
Q5.1_5 The clinic opening hours are suitable	721	2.90	0.92	1	5	164	3.28	1.05	1	5	4.62	0.00
Q5.1_6 The dentist's clinic is very modern	721	2.81	0.97	1	5	164	3.23	1.07	1	5	4.88	0.00
Q5.1_7 Good system of ventilation	721	2.80	0.97	1	5	164	3.26	1.04	1	5	5.35	0.00
Q6.1 How would you rate your experience in this complex	721	2.52	0.85	1	5	164	3.33	0.95	1	5	10.77	0.00

Questions	Pre-Training (DT)					Post-Training (R)					t-test	
	n	mean	sd	min	max	n	mean	sd	min	max	t	p.val
in General (1:strongly disagree, …, 5: strongly agree)												
Q6.1_1 Overall your treatment at this clinic made you happy	721	2.50	0.91	1	5	164	3.32	0.98	1	5	10.33	0.00
Q6.1_2 You will recommend this clinic to your family and friends	721	2.50	0.89	1	5	164	3.34	0.97	1	5	10.67	0.00
Q6.1_3 You are in a better health condition now	721	2.57	0.87	1	5	164	3.35	0.98	1	5	10.11	0.00
Q6.1_4 You are planning to return to this clinic	721	2.52	0.87	1	5	164	3.33	0.95	1	5	10.50	0.00
Q6.1_5 Your expectations have been met	721	2.51	0.87	1	5	164	3.33	0.94	1	5	10.66	0.00

1- P-value is significant at (0.05), and its value is (0.01), which indicates a statistically significant difference between the mean response of the research subjects on the axis of Staff Attributes in Pre-training (Routine) group-1; in which they did not receive any training, compared to Post-Training (Routine) group-3; in which they received Routine training. The mean scores for the Pre-Training group were (2.62 out of 5), while the mean scores for the Post-Training group-3 were (3.45 out of 5). Thus, we can see an increase in the patients' agreement on Staff Attributes in Post-Training group 3, in which the subjects received the Routine Training.

2- P-value is significant at (0.05), and its value is (0.01), which indicates a statistically significant difference between the mean response of the research subjects on the axis of Dentist Initiatives in Pre-training (Routine) group-1; in which they did not receive any training, compared to Post-Training (Routine) group-3; in which they received Routine training. The mean scores for the Pre-Training group were (2.58 out of 5), while the mean scores for the Post-Training-3 group were (3.20 out of 5). Thus, we can see an increase in the patients' agreement on Dentist Initiatives in Post-Training group 3, in which the subjects received the Routine Training.

3- P-value is significant at (0.05), and its value is (0.01), which indicates a statistically significant difference between the mean response of the research subjects on the axis of Physical Facilities in Pre-training (Routine) group-1; in which they did not receive any training, compared to Post-Training (Routine) group-3; in which they received Routine training. The mean scores for the Pre-Training group were (2.66 out of 5), while the mean scores for the Post-Training group were (3.21 out of 5). Thus, we can see an increase in the patients' agreement on Physical Facilities in Post-Training group 3, in which the subjects received the Routine Training.

4- P-value is significant at (0.05), and its value is (0.01), which indicates a statistically significant difference between the mean response of the research subjects on the axis of Patient Experience in General in Pre-training (Routine) group-1; in which they did not receive any training, compared to Post-Training (Routine) group-3; in which they received Design Thinking training. The mean scores for the Pre-Training group were (2.52 out of 5), while the mean scores for the Post-Training group-3 were (3.33 out of 5). Thus, we can see an increase

in the patients' agreement on Patient Experience in General in Post-Training group 3, in which the subjects received the Routine Training.

Comparative Qualitative Analysis

This data analysis is aimed at identifying the effect of design thinking and routinization on patient experience in a dental clinic. The analysis is in two folds, the first section discusses the impact of design thinking and routinization on the staffs while the second section explores its impacts on the patients.

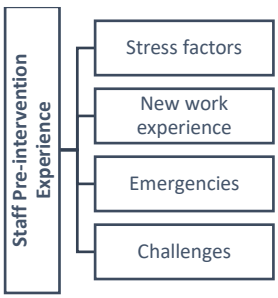
Impact of design thinking and routinization on staff perspective

The analysis under this section is further divided into two sections, the first section explores the experience of staff prior to intervention while the second section explores their experience after the intervention. This is done in a bid to measure the impact of the intervention through their perspective.

Staff Pre-intervention Experience

Qualitative data was gathered from 7 participants prior to the intervention. 4 of the participants are males while the rest are females. The majority of the participants have more than a decade of experience in dental care.

The analysis of the collected data reveals the following nodes, these nodes capture the entirety of the experience of the staff before the intervention.



Stress Factors

Stress reduces productivity, the theme is exploring the factors that make the work of a dental health practitioner a stressful endeavor;

i. Extended Work duration: Participants consider working for 8 hours continuously for 6 days an exhaustive endeavor.

ii. Meeting financial benchmark: Due to the nature of the work, it requires precision and time, participants often find it impossible to meet up with the financial income benchmark. This is partly due to the low inflow of patients into the facility.

iii. Maintaining Member 2essionalism with bad-mannered patients: Participants highlighted that maintaining a high level of Member 2essionalism with bad-mannered patients is often an exhaustive endeavor.

iv. Lack of support: The staffs believe they receive little or no support from the management.

v. Extended sitting period: Participants decry the long sitting time used in attending to appointments, highlighting that this often led to complex back problems.

vi. Demand for speed: Patients often demand speed in treating them, they often demand a quick fix. Quality treatment requires meticulousness and time.

vii. Appointment related issues: Oftentimes, patients miss their appointments, this often leads to complex time management related issues. They keep the doctors waiting and disrupt the appointment of others due to their lateness.

New Experience

A total of 5 participants have worked in other dental care facility prior to working the clinic, the theme is exploring what differentiates this clinic from other clinics;

i. Quality service: They believe the Centre provides better service than their previous place of employment.
ii. Presence of modern equipment
iii. High level of human resources: One of the participants highlighted that the facility is larger than his previous place of employment, thereby making it a hub for excellent human resources.
iv. Cultural Differences: A participant highlighted that he is yet to familiarize himself with the language and culture of the region. This is creating a significant barrier in communication between him and his patients.
v. Better working conditions: Participants highlighted that the clinic has well-equipped offices and better remuneration.

Managing Emergencies

One of the biggest challenges in the facility is managing emergencies, participants often experience great difficulty in handling emergency situations. Emergencies are treated immediately according to the organizations laid down the rule, however, this often results in patients missing their appointments as the doctors are busy attending to emergency situations. Affected patients are requested to wait or reschedule.

Challenges

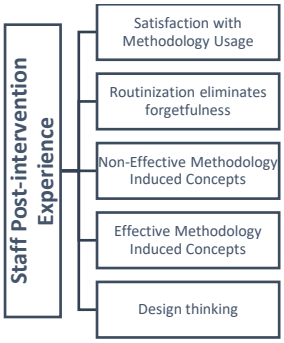
This section is exploring the challenges faced by participants during the course of discharging their duties. The analysis reveals that while some of the patients are identified immediately, some require cross-examination and extensive investigation. Furthermore, the analysis also reveals that the staff and patients are not often satisfied with the final resolution of the problems.

i. Teeth installation problem: Participants recalled a previous experience where a patient challenged the quality of work of the doctor. It was later discovered that the procedure was rightly carried out upon proper investigation.
ii. Staff Indiscipline: A situation where some staff is lazy and incompetent.
iii. Lack of patient cooperation
iv. Patient credibility/ Lack of proper medical history: Doctors need to rely on the health history given by the patients which are sometimes false.
v. Managing appointments and emergencies: This is one of the most prominent challenges as participants often find it difficult to effectively manage lateness of the patients to an appointment and the cancellation or rescheduling of appointments due to emergencies.
vi. Inability to eliminate pain
vii. Forgetfulness: Doctors and receptionists sometimes forget one or two procedures after working for several hours.
viii. Fear of treatment: Some patients are unwilling to take surgery or treatment, which often leads to more work time and persuasion.
ix. Discrimination: Patients are sometimes rude, believing that they can disrespect the doctor mainly because they paid for the service.

Staff Post-intervention Experience

Qualitative data was gathered from 7 participants after the intervention. The participants include; doctors, nurses and the receptionists working in the facility.

The analysis of the collected data reveals the following nodes, these nodes capture the entirety of the experience of the staff before the intervention.



Satisfaction with Methodology

All participants highlighted that they are satisfied with the general outcome of applying the principles gained from the intervention and they enjoyed a considerable level of pleasure in applying routinization and design thinking principles.

Routinization Eliminates forgetfulness

The pre-intervention state revealed that doctors and receptionists are sometimes forgetful after working for several hours. Participants highlighted that using the principles of routinization has assisted them in eliminating forgetfulness.

Effective Methodology Induced Concepts

i. WIFI to kill waiting time: This was introduced to ease the waiting time of the patients when they visit for appointments, it has been an effective

tool as fewer patients complain of long waiting times ever since its introduction.

ii. Limiting Procedure: The doctors limit the procedure and books another appointment for continuation of the procedure to effectively save time for other patients.

iii. Receptionist empathy: The receptionists now take their time to understand the patients, they become sympathetic to their situations and this has led to better reception management.

iv. Improved Sympathy and empathy: Through the use of proper observation and understanding, Doctors become sympathetic to the situations of the patients and this has led to a more cordial relationship between the doctors and the patients.

v. Improved cooperation through discussion

vi. Eliminating language barrier: One of the doctors highlighted that he took a language class to eliminate the existing language barrier.

vii. Discussion and explanation: The fixing of appointments with the patients is achieved after proper consultation with the patient.

viii. Developing multiple solutions and strategies: Through collective brainstorming, the staffs develop several solutions to and strategies to every problem and thereafter select the most effective and appropriate one.

ix. Mobile Phone Reminders: The use of phone calls and text messages to remind patients of appointments has effectively reduced the rate at which patients miss appointments.

x. Adjusting for cultural differences in gender communication.

Impact of Design Thinking

i. Staff sense of belonging: The collective thinking meeting has been effective in giving every member of staff a sense of belonging, which in turn fosters unity amongst the staff.

ii. Reduced of patient complains: The application of the principles has stirred a decrease in the number of patients complaints.

iii. Reduced understaff issues: The application of the principles has stirred a decrease in the number of staff quarrels.

iv. Patient referral: The rate at which patients recommend the clinic has increased considerably.

v. Lack of free clinics: The facility often lacks clinics for emergency situations due to the increase in the number of patient visits.

vi. Increased rate of repeated visits

vii. Improved income: The income of the clinic has increased considerably due to an increased inflow of patients.

viii. Improved cooperation amongst staff: Respondents highlighted that the cooperation amongst the staff has increased considerably.

ix. Expansion of parking space.

x. Discovery of receptionist incompetence.

xi. Collective decision making.

xii. Brainstorming yielded positive results.

Non-effective Methodology Induced Concepts

i. Price reduction: The reduction of price has not been ineffective in reducing the number of complaints due to cost as patients keep requesting for further discounts.

ii. Delays due to emergencies: The intervention has been unsuccessful in totally eliminating delays due to emergencies.

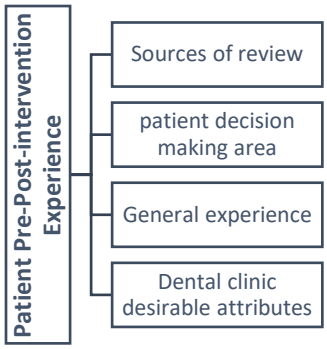
iii. Appointment cancellation: The methodology has been ineffective in eliminating the cancellation of appointments. Few patients still fail to show up for appointments and the reasons are beyond the control of the patients and clinicians.

Impact of design thinking on patient experience

The analysis under this section is further divided into two sections, the first section explores the experience of patients prior to intervention while the second section explores their experience after the intervention. This is done in a bid to measure the impact of the intervention through their experience.

Patients Pre and post-intervention Experience

Qualitative data was gathered from 14 participants prior to and after the intervention. All participants have visited the facility more than once. The analysis of the collected data reveals the following nodes, these nodes capture the entirety of the experience of the patients before and after the intervention.



Sources of Review/Recommendation

Participants highlighted that they rely on information from the following sources before deciding to visit the facility;

i. Word of mouth from family, friends, and colleagues

ii. Social Networks
iii. Price discounts
iv. Advertisement

Dental Clinic Desirable Attributes

Participants highlighted that they consider the following factors when selecting a dental care facility;

i. Short waiting time
ii. Clinic reputation
iii. Comfortability level of the reception
iv. Location of the clinic
v. Cost of treatment: The cost of treatment must be considerable and minimalistic
vi. Competence of the dentist

Patient Decision Making

Exploring the issues related to patient decision-making ability with regards to their care, the analysis of the collected data reveals that majority of the patients revealed their interest in holding the ultimate decision-making capability with regards to their care. However, majority of the patients highlighted that the doctors give them little or no influence on decision making.

General Experience

Patients Pre-intervention Experience

The general experience of patients before the intervention as revealed in the data is summarized below;

i. Wrong diagnosis: The patient highlighted that he was wrongly diagnosed.
ii. Unsatisfactory treatment: A patient highlighted that the treatment he received from the facility was unsatisfactory.

iii. Unclear appointment time: The given appointment time was not well communicated.

iv. Unbalanced distribution of work: Patients highlighted the presence of an unbalanced distribution of work when they visited the clinic, explain further that while some staff was busy, some were idle and discussing.

v. Not all doctors are competent: Participants highlighted that not all doctors who work within the facility are competent.

vi. Responsive management: The management of the facility is responding and solving the complaints.

vii. Presence of more services: Patients highlighted that the facility has a wide range of services that are not present in other dental care clinics.

viii. Old and non-noticeable building: Participants highlighted that the facility is old and its position is not easily noticed.

ix. Inadequate parking space

x. False payment plan: Some of the participants complained that the laid down payment plan is false, highlighting that the clinic often increases the payment upon admission of the patient.

xi. Extended waiting Time: Participants decry the long waiting time.

xii. Egocentric doctors: Proud and unsympathetic doctors.

xiii. Doctor Incompetence: Some of the doctors in the facility are incompetent.

xiv. Doctor Distraction: The doctors are sometimes distracted or engaged in discussions with their colleagues while performing procedures.

Patients Post-intervention Experience

The analysis of the collected data revealed the following in the experience of the patients after the intervention.

i. Well-mannered staff: Participants revealed that the staffs are calm and well-mannered in their manner of approach and discussion with them.
ii. Short waiting time: the waiting time has been reduced considerably.
iii. Satisfactory cleanliness: The level of cleanliness within the facility is adequate.
iv. Prompt emergency service: The emergency service delivery is prompt and adequate.
v. Lack of discussion: Participants still complain of a lack of communication between them and the doctor.
vi. Excellent time management: The participant highlighted that the appointment date is now fixed after consultation with them. Highlighting that this has significantly increased its punctuality to appointments.
vii. Excellent service
viii. Excellent reception: The reception is excellent, with friendly and well-mannered receptionists.
ix. Excellent online review
x. Excellent doctors: Presence of competent doctors.
xi. Emphasis on patient experience: Patients highlighted that the facility is now focused on the patients and their experience.
xii. Easy appointment rescheduling

xiii. Cost flexibility: Participants highlighted the presence of flexibility with regard to the cost of treatment. The facility has different cost levels for treatment with regards to the patient's preference.

xiv. Confidence in doctors: Patients highlighted that they have a significant level of confidence in their doctors.

The summary of the Impact of Design thinking and Routinization is summarized in the tables below;

For Staffs

S/N	Before Intervention	After Intervention
1	Forgetfulness	Elimination of forgetfulness through the use of notes
2	Staff quarrels	Improved cooperation through discussion
3	Language barrier	Eliminating language barrier
4	Rudeness of Staff	Improved Sympathy and empathy through discussion with the patient
5	Long waiting time	WIFI to kill waiting for time and Limiting of procedure
6	Rescheduling of appointments	Adherence to appointment dates through proper time management
7	Rude Receptionists	Discovery of uneducated receptionists
8	Inability to meet income benchmark	Increase in income

For patients

S/N	Before Intervention	After Intervention
1	Rude staff	Well-mannered staff
2	Extended waiting time	Short waiting time
3	Bad reception	Excellent reception
4	Lack of parking space	Presence of parking space
5	Unclear Appointment date	Use of phone calls and texts as appointment reminders
6	The high cost of treatment	Flexible cost of treatment
7	Doctor Incompetence	Confidence in doctors
8	Appointment cancellation	Easy appointment rescheduling

Chapter 6 Discussion and Recommendation

The aim of this study was to investigate the impact of design thinking on patient experience in dental clinics. The study sought to determine the relationship between patient perception toward a) staff attributes, b) dentist

initiative and c) physical facilities and experience levels and determine the relationship between staff perception of their skills of solving the problem, team dynamics, behaviour, Challenging, Psychological ownership, empathy, Perspective-taking and creative confidence.

In this research, the problem under investigation is what is the impact of design thinking on patient experience in dental clinics in Saudi Arabia?

Discussion

The study used design thinking methodology to make dental intervention materials more applicable to patients with various dental problems because they face similar problems, including communication breakdown, high treatment costs, delays in appointments, unsuitable treatments and other. The dental staff members had to undergo training organized by the researcher and research team through various design thinking workshop sessions. An assessment of the patients and staff after the design thinking intervention was effective in changing a number of outcomes, including a reduction in barriers to dental care, staff attributes, physical facilities and staff initiative. Previous health studies that have applied design thinking have also demonstrated improved communication, patient experience and healthcare programs (Roberts et al., 2016; Uehira & Kay, 2009; Blatt et al., 2010; Criscitelli & Goodwin, 2017).

This study indicates that there is no significant impact of design thinking methodology on empathy. One possible explanation of this finding is the difference in the coding of the utterances made by staff. An empathic statement understood by one staff as helpful can be considered neural or un-empathic by another staff. Given the highly distressing situations most staff find themselves

in (e.g. suffering, illnesses), staff may find it difficult to regulate their ability to empathize (Uehira & Kay, 2009). Contrary to this finding, Blatt et al (2010) found that providers' empathy results in improved patient satisfaction.

From this study, reduction in key barriers has a significant impact of design thinking methodology on patient experience. Participants in this study mentioned convenience as the most unfavorable component of dental services. The finding implies that dealing with the problem of hospital accessibility (location, opening hours, emergency services, appointment booking and admission of patients) helps improve patient experiences. In support of this view, Luo, Liu and Wong (2018) found that time spend solving dental problems affect patient satisfaction levels, including treatment duration, travel duration for each visit and waiting time while at the dental clinic.

Perspective-taking is a key element of patient satisfaction. This study indicates that there is a positive significant impact of design thinking methodology on perspective taking of patients. The explanation for this finding is that patients are more likely to be honest with healthcare providers with whom they are convinced that they understand them. Perspective-taking practices drive social bonds. Prior research has demonstrated that perspective-taking increases patients' satisfaction with the doctors (Blatt et al., 2010).

This study reveals that there is a positive significant impact of design thinking methodology on psychological ownership for work. Some contextual factors brought about during user (patient) engagement in the design thinking process my positively affect psychological ownership (Smith, Grant & Ramirez, 2014). Psychological ownership is positively related to trust in the workplace, and influences patient satisfaction. A study by Kaur, Sambasivan and Kumar

(2013) found that work environments which promoted workplace place increased the level of psychological ownership among employees, which in turn increases patient satisfaction and reduce their intention to seek for medical treatment elsewhere.

This study indicates that staff attributes significantly increase patient satisfaction, mediated by design thinking intervention. All staff attributes (communication, courtesy and friendliness, competence and staff care) influence patient satisfaction. Overall, participants emphasized on factors such as dentist concern questions, speed of the discharge process, collaboration between the staff, staff concern for privacy, staff skills, attitude toward the visitors, attention to personal needs, friendliness and courses. Many studies on patient satisfaction agree that patients consider staff care more important than the key barriers in relation to their overall satisfaction in hospital settings (Siddiqui et al., 2015; Otani et al., 2010).

This study also found that patient care, length of waiting time and length of treatment in the dental clinics has a profound influence on patients' satisfaction levels. Considering the increasing number of patients with dental problems, it is important to improve staff care, time required to make dental appointments and the waiting time before patients get the necessary treatment. The suggestion from the data in previous studies is that dental care management should pay more attention to staff care, waiting time, communication and staff competency to increase the overall patient rating of their dental clinics (Uehira & Kay, 2009; Siddiqui et al., 2015).

This study links perceptions of the quality of dental care to the clinics' efforts to optimize dental treatment. The responses to patients' overall

satisfaction with dental care relates to perceptions of dental assessment frequency, concern shown by the staff and response time. To corroborate the finding, Schoenfelder, Klewer and Kugler (2011) found that there are ten factors that determine global patient satisfaction. Of these factors, the treatment outcome took precedence followed by courtesy and kindness of the staff. Similarly, Luo, Liu and Wong (2018) showed that quality of dental services affect patient satisfaction, especially facilities, equipment, technology, manpower, improvements after treatment and perceived dentist skills.

This study showed that physical facilities significantly increase patient satisfaction, mediated by design thinking intervention. One possible explanation is that patients respond positively to comfortable and pleasing hospital environment. Overall, hospital environment and facilities affect patient satisfaction i.e. improve facilities improve satisfaction with dentists, nurses, receptionists and dental assistants. In line with this finding, Ali (2016) found that dental patients were more satisfied with the availability of adequate seats in the waiting area and suitability of the interior design.

This study demonstrates the role of clinic facilities in enhancing patient satisfaction. Most of the participants cited the importance of facility-related satisfaction factors, including cleanliness of the clinic rooms, comfort and accommodation of the visitors, room temperature, hospital environment and quietness of the dental rooms. Prior research indicates the increasing trend in which hospitals are currently designing their facilities with different patient-centered features, including positive distraction, improved natural light, private rooms, reduced noise, well-decorated rooms and visitor friendly facilities (Siddiqui et al., 2015; Ali, 2016).

This study shows that dentist initiative significantly increases patient satisfaction, mediated by design thinking intervention. The most significant factors that affect patient satisfaction are availability of dentists, clinical competency, commitment and punctuality, capacity to listen and empathize and ability to provide clear explanations. In addition, the kindness, courtesy and responsiveness of the dentists and nurses were critical turning points based on the patient responses, and can predict good patient experiences. Ali (2016) associated the dentists' performance with increased patient satisfaction. The work of Schoenfelder, T., Klewer, J. & Kugler (2011) supports this view, demonstrating that dentist initiative is linked directly to positive health outcomes that increase patient satisfaction.

Looking across the findings of this study, an additional broadly observed finding is the effect of team dynamics (team leaders, communication channels, established roles, teamwork, and time management). A range of design thinking outcomes, such as innovation observed can be traced to team dynamics and diversity. In this view, Seidel & Fixson (2013) found that novice multidisciplinary teams that receive guidance on design thinking can apply new solutions to the existing problems. Similarly, Criscitelli and Goodwin (2017) revealed that design thinking produces safer environments for patients and staff members and foster innovation in healthcare.

Team dynamics play a significant role during design thinking. This study shows that the presence of team leaders, clearly stated roles, appropriate communication channels and teamwork enabled the teams to derive innovative solutions, collaborate to solve new challenges and access knowledge and resources that facilitate quality dental service delivery. Overall, these factors

improve the creative process during design thinking. From previous research, teamwork, accountability and shared responsibility positively influence service delivery in healthcare (Uehira and Kay, 2009). Roberts et al (2016) also demonstrated how design thinking promotes new approaches to solving complex healthcare problems through rapid prototyping and diverse/collective teamwork.

This study demonstrates that design thinking improves behaviour attitude among dental staff. Given that design thinking is human-centered focus, one could argue that the engagement of many stakeholders, including nurses, dentists, receptionists and dental assistants, in the design process, might have encouraged attitude and behavior change. In support of this finding, Carlgren (2016) found that in innovation projects, design thinking results in a change in processes, attitude and behaviour. Luo, Liu and Wong (2018) also revealed that changing the attitude of the dentists and dental support staff led to positive views regarding the satisfaction levels towards dental care.

Creative confidence resulted in enhanced innovation. This finding might be attributed to the role of the researcher in inspiring the staff through the design thinking workshop to cultivate and promote their creative confidence in performing dental activities. In debriefs, the staff members felt that the workshop atmosphere was beneficially different compared to their own approach to dental care challenges. To engage a wider group of staff in innovation, staff members in this study used design thinking structured approach to improve their creative confidence and the quality of their productivity. In support of this view, Ulibarri et al (2014) found that design

thinking helps increase creative confidence, which in turn enhances innovative behaviour.

The findings demonstrate the development of staffs' empathic understanding of patient needs and context following a design thinking intervention. This finding is consistent with Calgren, Elmquist and Rauth (2016) who established that design thinking helps understand the users' context. Evidence of empathy was given by activities showing a major focus on empathy development among the staff, the utilization of ethnographic tools (e.g. interviews, observations and survey) and the subsequent adoption of the insights derived from the workshop to reframe dental problems and create solutions. The tools used included journey mapping, feedback capture grid, concept sketches and the creation of personas to demonstrate user needs. Seidel and Fixson (2013) demonstrate the significance of such tools.

Limitations

The first limitation is that the organizational cultures are local. Therefore, the approaches and tactics that worked for the specific dental clinics used in this research may not be directly applicable to other settings. As with all qualitative approaches in research, findings about the transferability of these results to other settings depend on understanding the study's context. The results are likely to be applied in other general dental practices with similar characteristics of the dental practices that formed the basis of this study. Nevertheless, this predominant new approach to design thinking coupled with empowering leadership behaviours in dental care can foster the desired culture change and improvement in service quality. The degree to which the results of

this study are transferable to other clinical contexts is a question for future empirical research.

Qualitative studies usually provide comprehensive information based on the cases used. In this study, there was a need for patients to provide detailed information. As such, they were carefully selected. The patients included had a prior history of exposure to curative as well as preventive care. What is more, they had various dental and oral issues, some high risk and other low risks. A standard instrument was used to measure the responses of all participants. The patients chosen to participate in the study were seeking dental care. Evidently, people who never attend or rarely seek dental treatment react differently. While most participants were eager to participate in the study, some patients might have opted out of the study, indicating selection bias.

When evaluating the effect of the design thinking intervention on patients and the dental staff, it is vital to recognize that the number of participants in the design thinking sessions kept on increasing from the third session due to referrals. The number of staff who participated is relatively small when carrying out statistical analyses. There is a possibility that the analyses carried out may be minimal approximations of the whole intervention and its impact on dental practice and patient experience. Direct contact among the participants during the design thinking sessions could have influenced their responses in the pre-surveys and post-surveys that were carried out.

This study is an intervention and not an experiment as there was no control group. So, causality cannot be inferred. The investigation was not carried out in a laboratory setting to compare the control group with the experimental group. The sampling frame did not contain all of the cities. It was

limited to one complex in the west of the country. Other healthcare problems were not considered. Therefore, there may be some generalizability problem. The conclusions made are only based on the observations, interpretations and interactions with the participants in the design thinking workshops. This study revealed some very informative findings which contribute to a void in the design thinking and dental practice literature.

The data collection process presents a limitation. The presence of the researcher in the workshops and interview sessions might have influenced the responses, given that the topic is very sensitive. In addition, some participants in the design thinking process influenced the responses of other participants. As such, some answers might be biased based on what is socially acceptable in healthcare practices.

The necessity of research measurement led me to give the participants in the workshops brief design challenges with specific objective performance criteria. Researchers and practitioners recommend diverse challenges and target goals to increase interest in various design thinking practices. However, these diverse challenges are more complex, necessitating more hours of work. Thus, comparing performance across dental staff becomes difficult. In the design thinking intervention, I could not use complex tasks in healthcare.

Experiment with control group	**Intervention without control group**
Random assignment of participants is possible	The researcher cannot randomly assign the participants to groups. Therefore, they have no control over the extraneous variables
The number of conditions can be one or more	Involves two or more number of conditions
High level of control	Moderate level of control
Sometimes allow the use of pre-tests or baseline measure	Baseline measures/pre-tests are used

Independent variable is always manipulated by the researcher, but not planned to influence the outcome.	Independent variable is either manipulated by the researcher, or the study involves observed/natural variables. The independent variable (X) is a planned intervention to influence the outcome (Y)

Recommendations for future studies

This study started an investigation into mechanisms to increase patient experience and increase dental practice. Although the study provides promising results and points to vital initial future directions, we believe much more research in this area is necessary. The workshop provided useful insights to a small proportion of the staff from the selected clinics. The participants envisioned numerous ways to expand dental practice across the clinics—additional research would be necessary to know whether expanding this specific workshop would hold value, or whether it is only the sub-set of staff who are motivated to explore new ways to improve their dental practice who benefit.

This study paid more attention to dental healthcare based on data obtained from participants in 7 dental clinics. This focus was in general terms, considering that design thinking is a wide topic. There are opportunities for future studies to shed light on the specific topics in relation to design thinking. These topics include empathy development across different approaches used, individual growth mindset, and analysis at team level, organization level (development of design thinking capabilities) as well as ecosystem level. What is more, forthcoming studies are encouraged in other areas of the healthcare sector and clinics to confirm the findings of this study and increase confidence in the validity of this study.

Dental healthcare is a complex phenomenon, and different patients have different expectations. Analyses of the patients with different levels of dental

diseases, cultural backgrounds and medical comorbidities would help understand better this complex phenomenon. What is more, there was little information concerning the facility-level attributes of the clinics. Future investigations should include and control various patient-level, staff-level and facility-level factors.

Conclusion

This study sought to investigate the impact of design thinking on dental care. It is based on the findings from seven dental clinics, taking into account the perspectives of patients and the dental staff. Data were collected via interviews and surveys it has been analyzed and presented. Special attention was paid to dental care practice, staff, service delivery in dental clinics, patient experience, design thinking and routinization interventions. The study demonstrates that design thinking and routinization interventions can help improve overall dental healthcare.

Apart from empathy, this study demonstrated that Skills of solving the problem, team dynamics, behaviour, Challenging, creative confidence, perspective-taking of patients and psychological ownership of the staff differ following the design thinking intervention. The study also showed that staff attributes, reduction in key barriers, physical facilities and dentist initiative significantly increase patient satisfaction, mediated by design thinking intervention. Dentist initiative, physical facilities and staff attributes are major factors that affect the caring behavior of dental care practitioners. These factors are important in efforts to improve the quality of dental patient care, through design thinking.

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