UNIVERSITI PUTRA MALAYSIA

FUNCTION-LED INNOVATION KIT FRAMEWORK FOR OCCUPATIONAL THERAPY CREATIVE ACTIVITIES PROCESS IN MALAYSIA

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FRSB 2022 14

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By

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

January 2022

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

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Chairman : Professor Ts. Khairul Aidil Azlin bin Abd Rahman, PhD
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Creative activities in rehabilitation setting especially in occupational therapy (OT) posits innovative adaptive tool (AT) used as a bridge to client's recovery during assessment and exercise. Creation covers from pediatric rehabilitation, cancer rehabilitation, musculoskeletal rehabilitation, psychosocial rehabilitation, geriatric rehabilitation, and pulmonary and cardiac rehabilitation. However, reported several reasons for non-use which include device failure (broken or non-functioning devices), incorrect prescription or fit with individual need, lack of appropriate instruction, feelings of embarrassment or awkwardness in device use, poor aesthetic quality, and denial of need or embarrassment over disability. Therefore, the main objective of the study is to enhance understanding among therapist as the expert user in rehabilitation setting on creative process; perhaps to facilitate better adaptive tool towards client's recovery by implementing design practice into their creation process. Mix-method exploratory sequential design were implemented with two instruments used to collect data which started with semi-structured interview and a questionnaire-based survey. Six experts from design and rehabilitation were interviewed to identify the adaptation creation attributes and followed by forty-two therapist's feedback on the survey based on their adaptation experience using design practice to support the findings. As a result, six adaptation attributes were identified via interview and validated through survey and an adaptation design framework for occupational therapy creative activities was developed. In future, results from this study will explore relevancies of design practice in other field especially for the expert user and are expected to lead new design approach to expert user in their creation activities. This will create awareness of good design and stimulus importance role of design and designer in the future.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KERANGKA ALAT FUNGSI-KE ARAH INOVASI UNTUK PROSES AKTIVITI KREATIF JURUTERAPI CARAKERJA DI MALAYSIA

Oleh

NURHIKMA BINTI MAT YUSOF

Januari 2022

Pengerusi : Profesor Ts. Khairul Aidil Azlin bin Abd Rahman, PhD
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Aktiviti kreatif dalam persekitaran rehabilitasi terutama dalam terapi cara kerja memaparkan inovasi alat adaptasi sebagai penyambung kepada pemulihan pelanggan semasa ujian dan senaman. Rekaan meliputi pemulihan kanak-kanak, pemulihan kanser, pemulihan otot, pemulihan psikososial, pemulihan warga tua, dan pemulihan pulmonari dan jantung. Walau bagaimanapun, terdapat laporan pengabaian alat adaptasi termasuklah disebabkan oleh kegagalan fungsi alat, penyelesaian yang tidak menepati keperluan pelanggan, arahan penggunaan alat yang tidak tepat, perasaan malu dan janggal dalam penggunaan alat, kelemahan kualiti estetik dan penolakan penggunaan atau rasa malu pada kekurangan diri. Maka, objektif utama kajian ini adalah untuk menambahbaik kefahaman dalam kalangan juruterapi carakerja sebagai pengguna pakar dalam persekitaran rehabilitasi terhadap proses kreatif; diharap dapat memudahkan alat adaptasi yang lebih baik terhadap pemulihan pelanggan dengan praktis rekabentuk ke dalam proses rekaan. Reka bentuk penerokaan berurutan dilaksanakan dengan dua instrumen digunakan untuk mengumpul data yang dimulakan dengan temubual separa struktur dan tinjauan soal selidik. Enam orang pakar dari reka bentuk dan rehabilitasi telah ditemubual untuk mengenalpasti sifat-sifat rekaan adaptasi dan diikuti dengan empat puluh dua maklum balas daripada tinjauan soal selidik ke atas pengalaman adaptasi menggunakan praktis rekabentuk untuk menyokong dapatan kajian. Hasil kajian mendapati enam sifat-sifat adaptasi yang dikenalpasti melalui temubual dan pengesahan dengan kaji selidik dan kerangka adaptasi rekabentuk untuk aktiviti kreatif terapi carakerja dihasilkan. Pada masa hadapan, hasil kajian ini akan menerokai praktis rekabentuk yang sesuai dalam bidang lain terutama untuk pengguna mahir dan diharapkan akan menerajui pendekatan rekabentuk baru dalam aktiviti kreatif mereka. Ini akan mewujudkan kesedaran tentang rekabentuk yang baik dan menggerakkan kepentingan peranan rekabentuk dan perekabentuk pada masa hadapan.

ACKNOWLEDGEMENTS

"In the name of Allah, The Most Gracious the Most Merciful"

I am grateful to Allah, with His mercy and will, I am able to undertake this research and finished it.

Firstly, I am dedicating my sincere appreciation to my supervisor, Associate Professor Dr Raja Ahmad Azmeer Bin Raja Ahmad Effendi, for encouragement, motivation, advice, support, and supervision throughout these few years. Without his guidance and constant feedback, this PhD would not have been achievable. Thank you to my supervisory committee, Dr Saiful Hasley, Dr Jusang Bolong, Dr Shahrizal Dolah and Dr Mohd Faiz for their constructive supervision and excellent feedback to improve the thesis.

Secondly, special dedication goes to Dr Ahmad Zamir Che Daud, senior lecturer of Unit of Occupational Therapy, Universiti Teknologi MARA, Puncak Alam for being the most assistance and advice especially on the occupational therapy exposure and opportunities. My dedication also goes to Associate Professor Dr Azahar Harun, my senior collique of UiTM Melaka for the amazing help on the development of the research tool and moral support.

My thanks also go to the Ministry of Health (MOH), director and staff of the involved hospitals, Hospital Universiti Sains Malaysia, Hospital Besar Melaka, Hospital Tuanku Jaafar and Hospital Serdang for their cooperation and participation to my research especially at the unit of Occupational Therapy. Not to forget, students of occupational therapy, Universiti Teknologi MARA Puncak Alam, the design experts from Technology Park Malaysia and all friends who involved directly or indirectly in the study.

My deepest gratitude to my family, my beloved father Haji Mat Yusof Bin Mat Yatim and Hajah Bibah Binti Abdul Rahman, my siblings, my feline buddies who have always given me encouragement, support, and love in completing my work.

I am also gratefully acknowledging the funding received towards my PhD from the Ministry of Higher Education that funded my academic scholarship throughout the study and the management of Universiti Teknologi MARA Shah Alam and Melaka for the great support and facilities.

Finally, to my dear self, Nurhikma Mat Yusof who has remained consistent and motivated throughout this PhD, you nailed it! Alhamdulillah may Allah bless the journey and His ilm', amen.

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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Date: 8 September 2022

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LIST OF ABBREVIATIONS

OT	Occupational Therapy
ADL	Activity of Daily Living
AT	Adaptive Tool
FLIK	Function-led Innovation Kit
ELD	Experience- led Design
DT	Design Thinking
MOH	Ministry of Health
MDA	Medical Device Authority
AMMI	The Association of Malaysian Medical Industries
MOSTI	Ministry of Science, Technology and Innovation
GLC	Government-Link-Company
TPM	Technology Park Malaysia
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

1.1 Research Background

Creative activities portray a person's inventive and imaginative aspiration of creating an art project and crafts that sometimes even leads to functional products. It depends on who is involved in the activities, albeit with or without talent, as there are no specific rules for validating creativity as long as the outcome is achieved. On the other hand, in a more formal terminology, it is always referred to as design. Design activities are guided by design processes, where the person in charge is equipped with basic design education and thus leads to creativity in a more organic but structured manner for better contextual outcome.

Design gained importance in Britain after the Industrial Revolution of the late 1700s. It blows design culture and thinking in various ways. Design grows in theories that sparked from daily issues. It is a systematic creating process of moulding an ideation into a useful object that combines art and science. Known as a discipline for life problem-solving, Archer (2007) considered design to be geared to meeting specific needs; it delivers sound results while simultaneously representing a range of technological, economic, advertising, beauty, ecological, cultural, and ethical attributes dictated by its features, commercial, and social context.

Bruce (2007) further stated how design was developed as a learning process that resulted from collaborations between cognitive psychologists (Department of Design Research, Royal College of Art) and mid-career teaching professionals (Design Education Unit of the College) back in the 1970s and 1980s. It demonstrates an intimate relation between the mental exercise of design and the mental exercise of learning, where when used as a learning medium in specific subjects of the curriculum showed improved learning ability, supposedly honed by experience gleaned in design subjects, that helped students digest other subjects better. Earlier, business innovation saw design concept being adopted in business areas. Schumpeter noted innovations in production order fell upon the shoulders of entrepreneurs, be it to create novel goods, transform old products into new market favourable forms, locate new raw material resources or expand product markets and last but not least, managing an industry.

In recent years, other fields have been adopting and implementing a design methodology called design thinking (DT) as a novel approach to address their intricate issues creatively and innovatively. Here, the term design thinking comprises of design practice and competence not limited to design context, but also for and with people without specific design qualifications, espcially those in management (p.123)(Mosely et al., 2018). Design-business collaboration via design thinking has resulted in product innovation, leading to high demand of education that integrates design thinking elements in the curricula.

In the other field of non-design, creation activities being introduced from innovation events including healthcare industry. Healthcare innovation can be seen mostly in the collaboration of engineering department via robotic application and computer science expertise for medical devices. Other than medical appliances, innovation and creative activities discovered happened in rehabilitation setting especially in the department of occupational therapy (OT). Globally, it is a profession concerned with promoting health and well-being through occupation which the goal to enable people participating in the activities of everyday life. Known as a creative profession, both as a practice and in its use of creative activities for the benefit of clients (Christopher Ernst & Andrew Moore, n.d., 2013), the occupational therapist modify or produce adaptive tools (AT) during therapy session to assist and assess patients in activity daily living (ADL) (Dige, 2018).

In Malaysia, the profession established under the Ministry of Health (MOH), and it serves for the inpatient, outpatient, health clinic, institution and community listed under the government sectors. Services include rehabilitation for orthopedic, psychosocial, pediatric, neurology, geriatric, cancer and musculoskeletal. Based on the statistics of filling posts of Allied Health Sciences Malaysia in March 2019, there were about 1310 of OT officers and therapists in the government hospitals and clinics. All patients were treated under the policy of client-centered which they shall respect the autonomy of the patient or client throughout all phases of the intervention process (Ministry of Health Malaysia, 2013). Same in other countries, the treatment and assessment process for clients mostly involves adaptive tool and were provided by the hospitals.

Table 1.1 : Statistic on the filling post of Occupational Therapy, Malaysia

Post	East Malaysia	West Malaysia	Total
Rehabilitation Officer (Occupational therapy) Grade U41, U44, U48	123	25	148
Rehabilitation Therapist (Occupational therapy) Grade U29, U32, U36, U38, U40	897	265	1162
			1310

(Source: Allied Health Sciences Malaysia, 2019)

These tools were bought by the hospital or being created to suit the client's usage. Innovation for adaptive tool was an alternative for low- and middle-income country as Malaysia and other third progressing countries in the world needs to get the same function from the existing tool but with the affordable price and local features (Gittler et al., 2017) (Owolabi et al., 2018).

Figure 1.1 : Example of Adaptive Tools
(Source: Unit of Occupational Therapy, Hospital Besar Melaka, 2020)

Research and development evolve in creation and innovation activities for rehabilitation in Malaysia are also being supported by the Ministry of Science, Technology, and Innovation (MOSTI) with the collaboration of government-link-company (GLC) such as Technology Park Malaysia (TPM) which the department of Industrial engineering involves in rehabilitation projects that focused more on the high technology for rehabilitation machines and tools. Unfortunately, less collaboration was made between the therapists in the hospitals. Interdisciplinary collaboration between related parties would benefit the clients and reduce the national budget for the rehabilitation equipment.

1.2 Problem Statement

Currently in Malaysia, creation and innovation actively made in the hospitals especially at the department of Occupational Therapy to fulfill the needs of patient due to factors stated above. However, several factors influenced the creation activities such as financial issues among the clients (Romli et al., 2017), non-compliance (Wielandt & Strong, 2000), discomfort design, low of aesthetic value (Hook et al., 2014) and even less of instructions and training which resulted to low rate of usage among the clients. Most of the tools were bought and 37% is imported from overseas as reported by the Malaysian Device Market Analysis (Qualtechs, 2017).

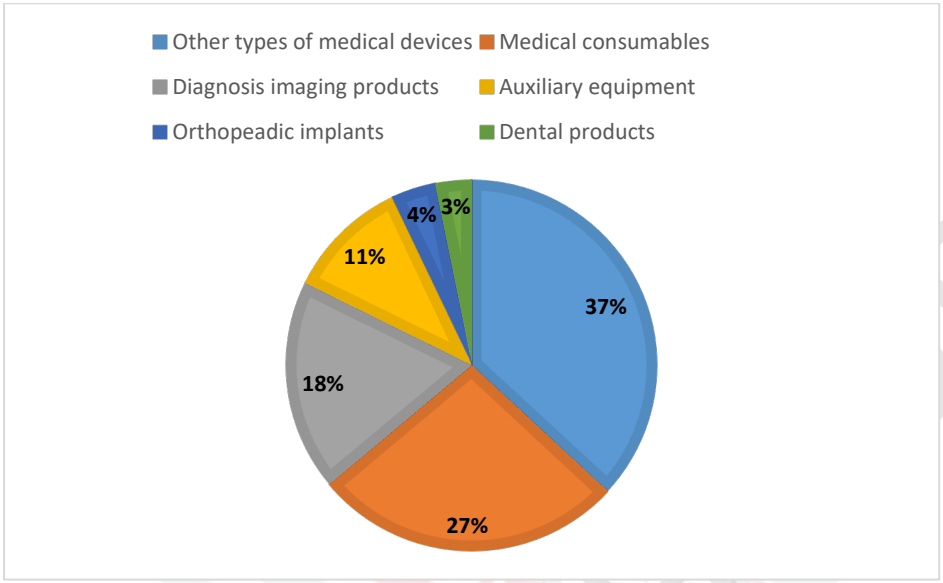

Figure 1.2 : Malaysian Medical Device Market Analysis
(Source: Qualtechs, 2017)

Furthermore, they did not occupy with related skills and hoping for proper tips and tricks to progress better creation. In this regard, creation knowledge is needed to assist occupational therapist to engage in their practices. At the moment, multiple models of occupation focused model (OFM) are being taught, claiming single occupation-centered models will not cover all practice nuances. However, this has resulted in the lack of information and confidence to apply any model in practice as the faced difficulty trying to convert them to their practice (Ashby, 2010). If this implication persists, it may endanger therapist ability due to improper AT distribution for treatment, ultimately affecting treatment results in rehabilitation.

In addition, current hospital procedure observed less supporting the process of innovation which somehow restricted the therapist effort to perform best during client's therapy session. Preliminary study captured low focused on the needs of the occupational therapy department which the management only provides basic and limited material such as foam, cardboard, wood for adaptive tool development while the innovation works requires considerate cost to assess client.

The therapist also found difficulty with validity of those creation as corresponding to Medical Device Act 2012 (Act 737), only the manufacturer of medical devices, medical device manufactured in foreign country, the authorized representative of the foreign manufacturer, as defined in Section 2 of Act 737 can make the

registration (Medical Device Authority Malaysia, 2012). Device in occupational therapy applies to gadget, apparatus, equipment which typically must be functional. However, devices for aesthetic (cosmetic) purposes are frequently employed to enhance look. Depending on their intended use and if they affect the structure or function of the body (FDA, 2020).

Therefore, this study concentrated on occupational therapy creative activities in which practitioners designates importance to the end result of participation, thus enabling interaction through adaptations and alterations of the environment or objects within the environment as needed (Therapy & Framework, 2014). Previously, there were several methods being explored by other health care players with designers such as e.g., surgeon involved in collaborative design (co-design) in enhancing their task in operation theatre room with designer's mocking-up strategies, physicians involved in hackathon, an interdisciplinary approach to enhance healthcare solutions and providing an educational experience for participants and many more. Thus, this study will focus on the specifics of design practice that can be implemented into OT creation activities which to achieve the goal to create an expert user design framework that can help therapists create better adaptive tools. This research will concentrate on rehabilitation innovation and support the third sustainable development goals in good health and well-being.

1.2.1 Preliminary Study

In conjunction to the issue of the research, a preliminary study is conducted to describe creative environment among the occupational therapy in Malaysia (Appendix A). The purpose is to determine validity of issue arose in the context. It is an initial exploration of issues related to a proposed quality review or evaluation that may be used to identify key features to be addressed in the research. Online survey is selected for this purpose and if conducted properly, online surveys have significant advantages over other formats (Evans & Mathur, 2005).

The academic evaluation of innovative activities was distributed among a group of occupational therapists on the platform of Facebook with the name of Malaysia Occupational Therapy Association (MOTA). The association assembles members with the background of occupational therapy including therapists, academicians, and students either from government hospital and private centers. For this preliminary survey, thirty participants obtained to participate in the survey. Results were discussed (Appendix B).

Via the preliminary study, 56% of the therapists spend five times per day consulting the patients while the rest spent between ten and more times per day based on the severity of impairment occured. The activity involves was either treatment or assessment to the patient with therapy tools that are mostly made

from the European countries. However, half of the participants agree that they will innovate or adapting new tool for the client (56.7%) if the tool does not meet the requirement of the activity. Meanwhile 43.3% oh the therapist prefer to change the type of therapy and others just requesting for new tool with 20% of score. The most created tool was functional treatment tools, followed by sensory treatment tools and physical treatment tools.

During the creation activity process, 70% answered 'yes' in resembling that there is direct and indirect interference by clients giving opinions for the adaptive tool. On the other hand, 30% accept what is given by the therapist for them. Based on their experience, the most challenging part is making the creation functions according to desired performance with 60% of votes. Followed by idea generation with 46.7%, making up with 40% and aesthetic elements with 36.7%.

As conclusion, In reliazing the lackness in the process of their creation activities, the participants agreed on opinion that there is a need for the occupational therapy to collaborate with product designer towards better rehabilitation tools for clients in the future. 93.3% vote for 'yes' for the statement and very minor refused it. At the comments and suggestions part, participants (occupational therapist) highlight several issues on innovating new tool. The comments and suggestions are as follows:

1. They found that innovations work might become costly and said that they prefer to use recycle material to maintain the ability of client to have the adaptive tool.
2. They feel easy to create tools, but they have difficulty with validity.
3. They urge the researcher to develop proper tips and tricks for younger occupational therapist to creatively provide appropriate adaptive tool with limited sources or material.
4. They hope that the researcher may investigate suitable treatment modalities, therapeutic approaches, and strategies for better therapy programs for client.

Upon this data analysis and comments from the participants, the researcher considers furthering the research to the next level, on how to guide design practice for the occupational therapist in Malaysia.

1.3 Research Objectives

The goal of this study is to assist occupational therapists in their creative activities session. In particular, the research objectives are:

1 To identify the attributes of creative activity process in occupational therapy.

2 To evaluate the effect of design practice to the occupational therapy creative activities.

3 To develop a design intervention framework for occupational therapy creative activities.

1.4 Research Questions

Main research question:

How to facilitate occupational therapy in their creative activities?

Three sub-questions:

1 What are the attributes of creative activities in occupational therapy?

2 Does design practice significantly effect to the occupational therapy creative activities?

3 How does the occupational therapy could apply design practice for their creation activities?

1.5 Research Context

This research investigates interdisciplinary purposes in creation and innovation activities across design and rehabilitation disciplines, which, with appropriate design strategy, may improve the creation process and outcome in non-design fields. As rehabilitation experts, they are the frontliners who are involved in the early design stages of adaptive tools through creation activities for client recovery and assessment. Despite their lack of design knowledge, they follow model guidance in the relevant field to modify or adapt the adaptive tool; unfortunately, low AT use situation became the focus of attention due to design discomfort, non-compliance, an unappealing appearance, lukewarm personal acceptance, and scarce training opportunities (Gitlin, Levine, & Geiger, 1993), (Wielandt & Strong, 2000), (Copley & Ziviani, 2004). Physicians and other healthcare practitioners are the major end users of medical innovation, as reported by Silver, J. K., Binder, D. S., Zubcevik, N., and Zafonte, R. D. (2016); that said, the initial stages of design seldom include their participations. As a

result, the solutions developed saw low adoption rates, in addition to ineffectiveness and inefficiency.

The first phase of research begins with a preliminary survey, which evaluates the creation activities that occurred in rehabilitation, particularly in the occupational therapy department. The second phase then focuses on the identification of adaptive tool (AT) attributes in a rehabilitation setting. Then, it was followed by assessing the therapist's understanding of the needs of creation activities in occupational therapy. The evaluation process entails selected design methods that suit occupational therapy practise toward a client-centered approach, as well as a discussion of design thinking theory (IDEO, 2015). The design innovation catalyst (DIC), a proposed new area for the design profession suggested by Wrigley (2016), is used as a reference in the process of conforming the study outcome.

The research was done specifically to broaden the role of design and designers by including non-design experts and possibly other experts who use creative activities as a strategy in their practise. This research can also provide positive design vibes and build confidence in their client service. It is thought that different fields may have different needs and criteria when conducting design problems. Nonetheless, the information obtained can serve as a starting point for non-design experts to understand the capability of design strategy in design or non-design application in problem solving.

1.6 Hypothesis

Based on RQ2, six hypotheses have been developed and tested through statistical analysis.

H1: There is statistically significant effect of design practice towards the creation knowledge in experiment group.

H2: There is statistically significant effect of design practice towards the creation method in experiment group.

H3: There is statistically significant effect of design practice towards the creation ability in experiment group.

H4: There is statistically significant effect of design practice towards the cost and material in experiment group.

H5: There is statistically significant effect of design practice towards the instructions and training in experiment group.

H6: There is statistically significant effect of design practice towards the procedure in experiment group.

1.7 Operational Definitions

To better understand the research, the following terms used in the study are defined. The terms are as follows.

Adaptive tool: it refers to aided tools that occupational therapists provide to clients for assessments or treatments.

Client: it includes individuals, families, groups, communities, organizations and populations who gets consultation or treatment in rehabilitation centre.

Client-centered; it refers to humanist philosophy which provides a foundation for occupational therapy practice.

Creation: it refers to any object or product created by occupational therapists during their creation activities.

Design practice: it refers to design-as-practice which drives a way of thinking about the process of design activities that are situated and distributed accomplishment with the existence of artefact.

Design innovation catalyst: a new design professional that translate and facilitate design observation, insight, meaning, and strategy for all facets of the organization.

Patient: a term which describes people of all ages who have physical, sensory, or cognitive problems and seek treatment or assessment at the rehabilitation centre.

1.8 Significance of Research

Design practice is recently being familiar in healthcare industry including rehabilitation. Previous studies showed involvement of health industry mostly in participatory, co-design and lead design. For occupational therapy, similarity of creative and user-centered perspective with design arena could create significant collaboration between both fields (Amiri et. al, 2017). Therefore, it is believed that by suggesting design practice in occupational therapy will demonstrate potential capabilities.

As low of collaboration made between both fields either outside or in Malaysia, theoretically, this study aims to extend the literature by integrating a promising practice that can improve creative practice of occupational therapy. Methodologically, this study further previous study between design and occupational therapy which only stops at the stage of interview. Experimental method that using different pretest-posttest designs are presented in a manner that can help rehabilitation professionals to better understand and determine effects resulting from selected interventions (Dimitrov & Rumrill, 2003).

Practically, this study contributes to the role of design and designers to the other fields as mediator in the preservation of good design via the implementation from the hat of 'design innovation catalyst' which provides the non-design experts with basic design knowledge and prepare them to consult their patients for continuous treatment or exercise on an affordable self-creation adaptive tool. It also serves as an alternative to establishing Malaysia rehabilitation centres with proper innovation cultures to achieve TN50 and move from rank 35 to best 10 in the World Innovation Index by 2020 and encouraged more local ideas and experience to increase access to effective rehabilitation tools in the future as suggested by the World Health Organization in 2012 (WHO, 2012).

1.9 Knowledge Contributions

For this study, several knowledge contributions can be obtained in both areas:

i) Academic contribution

It is a fundamental approach in design and interdisciplinary incorporating design practice to assist creative activities in other field with suitable design method. It guides steps of identifying creation attributes, evaluating design practice effect towards the attributes, and developing appropriate design approach that suits the activities.

ii) Practical contribution

For occupational therapy practice, it is an adding value to their creative activities to be guided accordingly. This creates understanding flow of design process and equip them with the design requirement in order to create a product. On the design practice, this study will extend the role of design and designers to other field, educate them with design knowledge and enhance the role of design innovation catalyst in the future.

1.10 Limitation of Research

The research aims to better understand occupational therapy practise in Malaysia in their creation activities. The data is strictly limited to participants with

an occupational therapy background (institutions and hospitals), as the creation activities of adaptive tool is conducted at these institutions. All hospital procedures for data collection were followed. They have tight working schedule and the researcher only had chance to meet them in full participation team by strictly appointment. It was only during 'Continuous Medical Education' (CME) once a month and last about one to two hours. As this research was the first attempt between design and occupational therapy, the openness on the topic was a bit hesitant which some of the participants and officer thought that it is not related in the practice, although they put much interest in design methodology such as 3D printing, art therapy and others. It might occur due to the influence of the evidence-based practice which accept successful implementation in the previous study and the practice only accept knowledge within the health science field. Moreover, there was limited information on the past adaptive tool created for the patient from the hospital. Most of the creation being repeated from previous years until now. The method of creation also limiting the creativity as it was based in the general guidance and the tool's expenditure from the hospital were not clearly recorded for referencing. Therefore, the researcher relied mostly on the studies in relation to build the research framework.

1.11 Thesis Outline

Chapter 1: **Introduction** – Chapter 1 first maps out research introduction by presenting its background, problem statement, objectives, and research questions. Next is the research context, significance, hypothesis, limitation of the research and operational definition. In chapter 2, a review of the subject and related information on the practice of OT and design are presented.

Chapter 2: **Literature review** – This chapter examines the academic literature on design education in general, as well as the strategies and methods used by designers in non-design fields. This chapter also discusses OT contextual practises for modifying or adapting rehabilitation tools during therapy sessions.

Chapter 3: Methodology – This chapter explains the rationale for the chosen research methodology as well as the study's methods based on the systematic phases and data collections. A mixed method research design was conducted to cover the issue which involve both qualitative and quantitative process of data collection were explained accordingly including research tool and instruments involved.

Chapter 4: Results and Discussion - This chapter discusses the results of qualitative data that extracts the creation attributes for occupational therapy and the quantitative findings upon the implementation of FLIK towards the attributes.

Chapter 5: **Summary, Conclusions and Recommendations for Future Research–** This chapter reported the conclusion and summary of the research contributions, as well as future research suggestions. Suggestions and limitations are also stated to support future applications on the framework.

REFERENCES

Amiri, T., Wagenfeld, A., & Reynolds, L. (2017). User wellbeing: an entry point for collaboration between occupational therapy and design. Design for Health, *1*(2), 187-193.

Archer, B. (1979). Design as a discipline. Design studies, *1*(1), 17-20.

Asaba, E., Nakamura, M., Asaba, A., & Kottorp, A. (2017). Integrating occupational therapy specific assessments in practice: exploring practitioner experiences. Occupational therapy international, 2017.

Ashby, S., & Chandler, B. (2010). An exploratory study of the occupation-focused models included in occupational therapy professional education programmes. British Journal of Occupational Therapy, 73(12), 616-624.

Bastien, J. C. (2010). Usability testing: a review of some methodological and technical aspects of the method. International journal of medical informatics, 79(4), e18-e23.

Blanche, E. I. (2007). The expression of creativity through occupation. *Journal of Occupational Science*, *14*(1), 21-29.

Boisselle, A. K., & Baxter, M. F. (2017). Masters of Occupational Therapy Student Perceptions of Creative Thinking Across the Academic Program. The Open Journal of Occupational Therapy, 5(4), 7.

Bruns, E. J., Pullmann, M. D., Nicodimos, S., Lyon, A. R., Ludwig, K., Namkung, N., & McCauley, E. (2019). Pilot test of an engagement, triage, and brief intervention strategy for school mental health. School Mental Health, 11(1), 148-162.

Chih-Pei, H. U., & Chang, Y. Y. (2017). John W. Creswell, research design: Qualitative, quantitative, and mixed methods approaches. Journal of Social and Administrative Sciences, 4(2), 205-207.

Colquhoun, H. L., Squires, J. E., Kolehmainen, N., Fraser, C., & Grimshaw, J. M. (2017). Methods for designing interventions to change healthcare professionals' behaviour: a systematic review. Implementation Science, 12(1), 1-11.

Copley, J., & Ziviani, J. (2004). Barriers to the use of assistive technology for children with multiple disabilities. Occupational Therapy International, 11(4), 229-243.

Cook, T. D., & Campbell, D. T. (1986). The causal assumptions of quasi-experimental practice: The origins of quasi-experimental practice. Synthese, 141-180.

Creswell, J. W. (1994). Research design.

Chih-Pei, H. U., & Chang, Y. Y. (2017). John W. Creswell, research design: Qualitative, quantitative, and mixed methods approaches. Journal of Social and Administrative Sciences, 4(2), 205-207.

De Couvreur, L., Dejonghe, W., Detand, J., & Goossens, R. (2013). The role of subjective well-being in co-designing open-design assistive devices. International Journal of Design, 7(3), 57-70.

Dige, M. (2009). Occupational therapy, professional development, andethics. Scandinavian Journal of Occupational Therapy, 16(2), 88-98.

Deininger, M., Daly, S. R., Sienko, K. H., & Lee, J. C. (2017). Novice designers' use of prototypes in engineering design. Design studies, 51, 25-65.

Dimitrov, D. M., & Rumrill Jr, P. D. (2003). Pretest-posttest designs and measurement of change. *Work*, *20*(2), 159-165.

Ernst, C., & Moore, A. (2013). The Nature of Creativity in Occupational Therapy.

Evans, J. R., & Mathur, A. (2005). The value of online surveys. Internet research.FitzPatrick, B. (2019). Validity in qualitative health education research. Currents in Pharmacy Teaching and Learning, 11(2), 211-217.

Fenn, T., & Hobbs, J. (2017). Experience-led Design Strategy. In Design Management Academy Conference 2017, July.

Gitlin, L. N., Levine, R., & Geiger, C. (1993). Adaptive device use by older adults with mixed disabilities. Archives of Physical Medicine and Rehabilitation, 74(2), 149-152.

Gittler, M., Thomas, J. L., Bozza, M. N., Berlinger, N., & Mukherjee, D. (2017).Undocumented Patients and Rehabilitation Services.

Hammel, R. C., & Mosely, G. (2017). Educating design innovation catalysts through design interventions. Design Management Academy.

Han, X., Li, R., Wang, J., Qin, S., & Ding, G. (2018). Identification of key design characteristics for complex product adaptive design. The International Journal of Advanced Manufacturing Technology, 95(1), 1215-1231.

Hook, J., Verbaan, S., Durrant, A., Olivier, P., & Wright, P. (2014, June). A study of the challenges related to DIY assistive technology in the context of children with disabilities. In Proceedings of the 2014 conference on Designing interactive systems (pp. 597-606).

Hughes, R. G. (2008). Tools and strategies for quality improvement and patient safety. Patient safety and quality: An evidence-based handbook for nurses.

Kongkasuwan, R., Voraakhom, K., Pisolayabutra, P., Maneechai, P., Boonin, J., & Kuptniratsaikul, V. (2016). Creative art therapy to enhance rehabilitation for stroke patients: a randomized controlled trial. *Clinical rehabilitation*, *30*(10), 1016-1023.

Lloyd, C., & Maas, F. (1992). Interpersonal skills and occupational therapy. *British Journal of Occupational Therapy*, *55*(10), 379-382.

Machingura, T., & Lloyd, C. (2017). Contemporary occupational therapy: Disruption or transformation. *International Journal of Therapy and Rehabilitation*, *24*(1), 3-4.

Mann, W. C., Ottenbacher, K. J., Fraas, L., Tomita, M., & Granger, C. V. (1999). Effectiveness of assistive technology and environmental interventions in maintaining independence and reducing home care costs for the frail elderly: A randomized controlled trial. *Archives of family Medicine*, *8*(3), 210.

McDonnell, J. (2016). Scaffolding practices: A study of design practitioner engagement in design education. *Design studies*, *45*, 9-29.

Mosely, G., Wright, N., & Wrigley, C. (2018). Facilitating design thinking: A comparison of design expertise. *Thinking Skills and Creativity*, *27*, 177-189.

Mosely, G., Wright, N., & Wrigley, C. (2018). Facilitating design thinking: A comparison of design expertise. *Thinking Skills and Creativity*, *27*, 177-189.

Müllersdorf, M., & Ivarsson, A. B. (2012). Use of creative activities in occupational therapy practice in Sweden. *Occupational therapy international*, *19*(3), 127-134.

Müllersdorf, M., & Ivarsson, A. B. (2016). What, why, how–Creative activities in occupational therapy practice in Sweden. *Occupational therapy international*, *23*(4), 369-378.

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International journal of qualitative methods*, *16*(1), 1609406917733847.

Owolabi, M., Ogunniyi, A., Hamzat, T. K., Platz, T., & Khan, F. (2017). Call for Papers: Neuro-rehabilitation in low and middle income countries: Adaptations and Innovations.

Pérez-Nombela, S., & Gil-Agudo, Á. Advances In Occupational Therapy Research: New Perspectives In Occupational Therapy.

Perruzza, N., & Kinsella, E. A. (2010). Creative arts occupations in therapeutic practice: a review of the literature. British journal of occupational therapy, 73(6), 261-268.

Partridge, R. (2017). Understanding the roles of the designer in health care: A practice-based study into supporting adolescents with long-term conditions. The Design Journal, *20*(4), 523-532.

Pérez-Nombela, S., & Gil-Agudo, Á. Advances in Occupational Therapy Research: New Perspectives In Occupational Therapy

Price, R., Wrigley, C., & Matthews, J. (2021). Action researcher to design innovation catalyst: Building design capability from within. Action Research, *19*(2), 318-337.

Raworth, K., Sweetman, C., Narayan, S., Rowlands, J., & Hopkins, A. (2012). Conducting semi-structured Interviews. Oxfam.

Renda, G., & Kuys, B. (2015). Connectivism as a pedagogical model within industrial design education. Procedia Technology, 20, 15-19.

Romli, M. H., Mackenzie, L., Tan, M. P., Lovarini, M., & Clemson, L. (2017). The experience of malaysian occupational therapists in conducting home assessments and home visits with older clients. Malaysian J Med Health Sci, 13, 17-25.

Sallis, R., Franklin, B., Joy, L., Ross, R., Sabgir, D., & Stone, J. (2015). Strategies for promoting physical activity in clinical practice. *Progress in cardiovascular diseases*, *57*(4), 375-386.

Schkade, J. K., & Schultz, S. (1992). Occupational adaptation: Toward a holistic approach for contemporary practice, part 1. American Journal of Occupational Therapy, 46(9), 829-837.

Silver, J. K., Binder, D. S., Zubcevik, N., & Zafonte, R. D. (2016). Healthcare hackathons provide educational and innovation opportunities: a case study and best practice recommendations. Journal of medical systems, 40(7), 1-7.

Söderback, I. (Ed.). (2009). International handbook of occupational therapy interventions (pp. 403-411). New York: Springer.

Straker, K., & Wrigley, C. (2014). Design innovation catalyst tools to facilitate organisational change. In Proceedings of the 19th DMI: Academic Design Management Conference (pp. 2600-2616). Design Management Institute.

Sung, C., Muller, V., Jones, J. E., & Chan, F. (2014). Vocational rehabilitation service patterns and employment outcomes of people with epilepsy. Epilepsy research, 108(8), 1469-1479.

Suominen, S., & Pöyry-Lassila, P. (2013). Effectiveness of Co-Design Intervention–Adopting Service Co-Development Thinking. In CO-CREATE 2013: The Boundary-Crossing Conference on Co-Design in Innovation. Aalto University.

Warrens, M. J. (2015). Five ways to look at Cohen's kappa. Journal of Psychology & Psychotherapy, 5(4), 1.

Wielandt, T., & Strong, J. (2000). Compliance with prescribed adaptive equipment: a literature review. British Journal of Occupational Therapy, 63(2), 65-75.

Wrigley, C. (2016). Design innovation catalysts: Education and impact. She Ji: The Journal of Design, Economics, and Innovation, 2(2), 148-165.

Wong, S. R., & Fisher, G. (2015). Comparing and using occupation-focused models. Occupational therapy in health care, 29(3), 297-315.

World Health Organization. (2012). Local production and technology transfer to increase access to medical devices: addressing the barriers and challenges in low-and middle-income countries.

Yoon, J., Pohlmeyer, A. E., & Desmet, P. (2016). When'feeling good'is not good enough: seven key opportunities for emotional granularity in product development. International Journal of Design, 10(3), 1-15.