INNOVATIVE ANGKLUNG BASED INTERVENTION FOR ELDERLY CARE: A CASE STUDY ON THE DEVELOPMENT OF ASLUNG AND DIGITAL APPLICATION AS ASSISTIVE TOOLS

MUHAMMAD ASYRAF BIN MOHD BAKRI

UNIVERSITI SAINS MALAYSIA

2025

INNOVATIVE ANGKLUNG BASED INTERVENTION FOR ELDERLY CARE: A CASE STUDY ON THE DEVELOPMENT OF ASLUNG AND DIGITAL APPLICATION AS ASSISTIVE TOOLS

by

MUHAMMAD ASYRAF BIN MOHD BAKRI

Thesis submitted in fulfilment of the requirements
for the degree of
Doctor of Philosophy

February 2025

ACKNOWLEDGEMENT

Alhamdulillah, all praise to Allah SWT for the blessings that have enabled me to complete this thesis. My deepest gratitude goes to my beloved parents and family for their unwavering support: my father Mohd Bakri Ahmad, my mother Roszeta Yusoff, and my siblings Noorain, Nooradila and Aqil Danial. I am sincerely thankful to my supervisors, Dr. Mohammad Kamal Sabran and Associate Professor Dr. Asrenee Ab Razak, for their invaluable guidance. My appreciation also goes to the lecturers, staff, and research assistants at Universiti Sains Malaysia. I would also like to extend my heartfelt thanks to my clique from the School of Applied Creative Arts and Design at Han Chiang University College of Communication for their continuous support and encouragement throughout my academic journey. Special thanks to the Dementia Support Group Kelantan, the residents and staff of Shalis Care Center, Caring Retirement Home Care, and Pusat Jagaan Damai Permai for their crucial participation in the Angklung Healing Art Project. I am also grateful to the USM JEPEM Ethics Committee for their approval. In loving memory of the late Dr. Ismail Lasa, whose guidance remains unforgettable. I also wish to thank Dr. Vincent Tee, Dr. Ahmad Shahril Ab Halim, Dr. Siti Nur Najibah Fauzi, Dr. Ungku Ahmad Ameen Ungku Mohd Zam, Dr. Cecilia Chan Woen Min, and the dedicated caregivers at BSC Eldercare Center. Special thanks also to YM Raja Iza Akhmar, Dany Angklung Sari Rejeky, and health design experts Dr. Muhammad Jameel Mohamed Kamil CIDe, Ts. Dr. Rosalam Che Me, and Ts. Dr. Saiful Hasley Ramli.Lastly, my heartfelt thanks to my study colleagues, co-authors, and the media for their support. This acknowledgment may not cover every act of kindness, but it expresses my deep gratitude. Thank you.

TABLE OF CONTENTS

ACKNOWLEDGEMENT ..... **ii**

TABLE OF CONTENTS ..... **iii**

LIST OF TABLES ..... **xvi**

LIST OF FIGURES ..... **xxiii**

LIST OF PLATES ..... **xxvi**

LIST OF ABBREVIATIONS ..... **xxxiii**

LIST OF APPENDICES ..... **xxxvi**

ABSTRAK ..... **xxxvii**

ABSTRACT ..... **xxxix**

CHAPTER 1 INTRODUCTION **1**

1.1 Introduction 1

1.2 Problem Statement 3

1.3 Background of Study 10

1.4 Research Aims 13

1.5 Research Questions 14

1.6 Research Objectives 14

1.7 Scope of the Study 15

1.8 Significant of the Study 16

1.9 Limitation of The Study 19

1.10 Structure of The Thesis 20

1.11 Conclusion 24

CHAPTER 2 LITERATURE REVIEW **25**

2.1 Introduction 25

2.2 Angklung 25

2.2.1 History of Angklung 25

2.2.1(a) History of Angklung Malaysia 30
2.2.2 Material Angklung 31
2.2.3 Design Angklung 33
2.2.4 Type of Angklung 38
2.2.4(a) Angklung Melody 38
2.2.4(b) Angklung accompaniment 40
2.2.4(c) Angklung Unit 43
2.2.5 Angklung Performance Technique 44
2.2.5(a) Ways Notation 44
2.2.5(a)(i) Indonesian Ways Notation 44
2.2.5(a)(ii) Malaysia Ways Notation 46
2.2.5(a)(iii) Strength and Limitation 48
2.2.5(b) Holding Technique 51
2.2.5(b)(i) Indonesian Holding Technique 51
2.2.5(b)(ii) Malaysia Holding Technique 54
2.2.5(b)(iii) Strength and Limitation 56
2.2.6 Sound Angklung 58
2.2.7 Development Angklung 60
2.2.8 Benefits of Angklung 64
2.3 Aging 66
2.3.1 Population Elderly 66
2.3.2 Aging in Health 67
2.3.3 Quality of Life 69
2.3.4 Support Institutions Elderly 71
2.3.4(a) Types of Care Centers in Malaysia 72
2.3.4(b) Special Housing for Elderly 73
2.3.4(c) Private Housing for Elderly 74

2.3.4(d) Support Services Elderly 74
2.3.5 Stage of Disease of Elderly 76
2.3.5(a) Physical 79
2.3.5(a)(i) Sensory Function 79
2.3.5(b) Level of Independence 83
2.3.5(b)(i) Mobility 83
2.3.5(c) Psychological 85
2.3.5(c)(i) Thinking, learning, memory and concentration 85
2.3.6 Type of treatment elderly 89
2.3.6(a) Pharmacology 89
2.3.6(b) Non pharmacology 90
2.3.7 Benefit Active Lifestyle Elderly 92
2.3.8 Need of Alternative Non-Pharmacological Interventions 93
2.4 Art-based Intervention 96
2.4.1 The Role of Art in Health 96
2.4.2 Angklung as an Art-Based Intervention for Elderly 98
2.5 Assistive Technology 104
2.5.1 Assistive technology Current Research 104
2.5.2 Category Assistive Technology 106
2.5.3 Product Assistive Technology for Elderly 111
2.5.4 Assistive Technology in Angklung Games for Elderly Art-Based Intervention 113
2.6 Conceptual Design Framework 122
2.7 Conclusion 123
CHAPTER 3 METHODOLOGY 127
3.1 Introduction 127
3.2 Qualitative Descriptive Study: A Case Study Approach 127

3.3 Theoretical Framework 130

3.3.1 User Centered Design, Research Through Design, Inclusive Design and Design for Disability 131

3.4 Design Project 144

3.4.1 Phase 1: Introduction 146

3.4.2 Phase 2: Literature Review 147

3.4.3 Phase 3: Methodology 148

3.4.4 Phase 4: Prototype Development 149

3.4.5 Phase 5: Data Collection 152

3.4.5(a) Preliminary Research 152

3.4.5(b) Usability Test 153

3.4.5(c) Second Testing 157

3.4.5(d) Validation 159

3.5 Sampling 161

3.5.1 Location of the study 161

3.5.2 Population of the study 161

3.6 The Inclusion of (Target) Users 162

3.6.1 Citizens over the age of 65 162

3.6.2 The caregivers 164

3.6.3 Experts and doctors in the field 165

3.7 Operational Definition 166

3.7.1 Angklung 166

3.7.2 Art-based Intervention 166

3.7.3 Ageing 166

3.7.4 Elderly 166

3.7.5 Mild elderly 167

3.7.6 Moderate elderly 167

3.7.7 Eldercare Center 167

3.7.8 Quality of Life 167
3.7.9 Assistive Technology 167
3.7.10 Aslung 168
3.7.11 Digital Visual Notation Conductor (DVNC) 168
3.7.12 User-Centered Design (UCD) 168
3.7.13 Research Through Design (RTD) 168
3.7.14 Design for Disability (DFD) 169
3.7.15 Inclusive Design (ID) 169
3.7.16 Usability Test (UT) 169
3.7.17 World Health Organization (WHO) 169
3.7.18 Elderly Cognitive Assessment Questionnaire (ECAQ) 170
3.7.19 Montreal Cognitive Assessment (MoCA) 170
3.7.20 Angklung Healing Art Project 170
3.8 Instrumentation 170
3.8.1 Elderly Cognitive Assessment Questionnaire (ECAQ) 170
3.8.2 Montreal Cognitive Assessment (MoCA) 171
3.8.3 Interview 171
3.8.4 Observation 172
3.8.4(a) Observations use event sampling 172
3.8.4(b) Participant observation 173
3.9 Ethic Consideration 174
3.9.1 Participant vulnerability 174
3.9.2 Declaration of absence of conflict of interest 175
3.9.3 Privacy and confidentiality 175
3.9.4 Community sensitivities and benefits 175
3.9.5 Honorarium and incentives 176
3.9.6 Other ethical review board approval 176

3.10 Research Workflow Chart....177
3.11 Conclusion....178
CHAPTER 4 PROTOTYPE DEVELOPMENT....179
4.1 Introduction....179
4.2 Preliminary research....179
4.2.1 Expert Demography....180
4.2.2 Expert Recommendation....181
4.2.3 Shalis Care Centre....182
4.2.3(a) Development Prototype....182
4.2.3(b) Model Making....183
4.2.4 Caring Retirement Home Care....184
4.2.4(a) Development Prototype....184
4.2.4(b) Model Making....185
4.2.5 Pusat Jagaan Damai Permai....186
4.2.5(a) Development Prototype....186
4.2.5(b) Model Making....186
4.2.6 Conclusion....187
4.3 Usability Test....188
4.3.1 Development Prototype....191
4.3.1(a) Aslung....191
4.3.1(b) Digital Visual Notation Conductor (DVNC)....196
4.3.2 Model making....200
4.3.2(a) Aslung....201
4.3.2(b) Digital Visual Notation Conductor (DVNC)....207
4.3.3 Conclusion....210
4.4 Second Testing....211
4.4.1 Development prototype....212

4.4.1(a) Aslung 212
4.4.1(b) Digital Visual Notation Conductor 213
4.4.2 Model Refinement 214
4.4.2(a) Aslung 215
4.4.2(b) Digital Visual Notation Conductor (DVNC) 216
4.4.3 Conclusion 220
CHAPTER 5 ANALYSIS AND INTERPRETATION 222
5.1 Introduction 222
5.2 Literature review 222
5.3 Preliminary Research 223
5.3.1 Expert Recommendation 224
5.3.1(a) Expert Demography 224
5.3.1(b) Expert Suggestion 227
5.3.2 Fieldwork 228
5.3.2(a) Shalis Care Center 228
5.3.2(a)(i) Methodology 229
5.3.2(b) Caring Retirement Home Care 231
5.3.2(b)(i) Methodology 232
5.3.2(c) Pusat Jagaan Damai Permai 234
5.3.2(c)(i) Methodology 235
5.3.3 Data Collection 237
5.3.3(a) Result 238
5.3.3(a)(i) Assessment 238
5.3.3(a)(ii) Experiment 239
5.3.3(a)(iii) Physical 241
5.3.3(a)(iv) Level of Independence 246
5.3.3(a)(v) Psychological 250

5.3.3(b) Quality of Life Elderly 260
5.3.3(b)(i) Physical 262
5.3.3(b)(ii) Psychological 264
5.3.3(b)(iii) Level of independence 267
5.3.3(b)(iv) Social relationships 271
5.3.3(b)(v) Environment 274
5.4 Usability Test 278
5.4.1 Week 1 279
5.4.1(a) Preparation 279
5.4.1(b) Instruments 279
5.4.1(c) Sampling 280
5.4.1(d) Intervention 280
5.4.2 Week 2 281
5.4.2(a) Preparation 281
5.4.2(b) Instruments 281
5.4.2(c) Sampling 281
5.4.2(d) Intervention 282
5.4.2(d)(i) Phase 3 (slow) 282
5.4.2(d)(ii) Phase 2 (medium) 292
5.4.2(d)(iii) Phase 1 (normal) 294
5.4.3 Week 3 296
5.4.3(a) Preparation 296
5.4.3(b) Instruments 296
5.4.3(c) Sampling 296
5.4.3(d) Intervention 296
5.4.3(d)(i) Phase 3 (slow) 297
5.4.3(d)(ii) Phase 2 (medium) 301

5.4.3(d)(iii) Phase 1 (normal) 303
5.4.4 Week 4 309
5.4.4(a) Preparation 309
5.4.4(b) Instruments 309
5.4.4(c) Sampling 310
5.4.4(d) Intervention 311
5.4.4(d)(i) Phase 3 (slow) 312
5.4.4(d)(ii) Phase 2 (medium) 315
5.4.4(d)(iii) Phase 1 (normal) 318
5.4.4(e) Assistive Technology HarmonyGuide Assistek 320
5.4.4(e)(i) Physical 321
5.4.4(e)(ii) Level of Independence 323
5.4.4(e)(iii) Psychological 326
5.5 Second Testing 333
5.5.1 Week 1 333
5.5.1(a) Preparation 333
5.5.1(b) Instruments 333
5.5.1(c) Sampling 334
5.5.1(d) Intervention 334
5.5.2 Week 2 335
5.5.2(a) Preparation 335
5.5.2(b) Instruments 335
5.5.2(c) Sampling 335
5.5.2(d) Intervention 335
5.5.2(d)(i) Phase 3 (slow) 336
5.5.2(d)(ii) Phase 2 (medium) 340
5.5.2(d)(iii) Phase 1 (normal) 344

5.5.3 Week 3 346
5.5.3(a) Preparation 346
5.5.3(b) Instruments 346
5.5.3(c) Sampling 346
5.5.3(d) Intervention 347
5.5.3(d)(i) Phase 3 (slow) 347
5.5.3(d)(ii) Phase 2 (medium) 350
5.5.3(d)(iii) Phase 1 (normal) 353
5.5.4 Week 4 354
5.5.4(a) Preparation 354
5.5.4(b) Instruments 354
5.5.4(c) Sampling 354
5.5.4(d) Intervention 355
5.5.4(d)(i) Phase 3 (slow) 357
5.5.4(d)(ii) Phase 2 (medium) 361
5.5.4(d)(iii) Phase 1 (normal) 365
5.5.4(e) Assistive Technology HarmonyGuide Assistek 367
5.5.4(e)(i) Physical 368
5.5.4(e)(ii) Level of Independence 371
5.5.4(e)(iii) Psychological 374
5.5.4(f) Quality of Life Elderly 380
5.5.4(f)(i) Physical 380
5.5.4(f)(ii) Psychological 381
5.5.4(f)(iii) Level of independence 384
5.5.4(f)(iv) Social relationships 386
5.5.4(f)(v) Environment 388
5.6 Validation 393

5.6.1 Introduction 394

5.6.2 Impact usability of HarmonyGuide Assistek. 394

5.6.2(a) Physical 394

5.6.2(a)(i) Sensory function 394

5.6.2(b) Level of Independence 401

5.6.2(b)(i) Mobility 401

5.6.2(c) Psychological 409

5.6.2(c)(i) Thinking learning, memory and concentration 409

5.6.3 Impact Quality of Life Elderly 422

5.6.3(a) Physical 422

5.6.3(a)(i) Sensory functions 422

5.6.3(b) Psychological 425

5.6.3(b)(i) Positive feelings 425

5.6.3(b)(ii) Thinking, learning, memory and concentration 428

5.6.3(b)(iii) Negative feelings 431

5.6.3(c) Level of independence 435

5.6.3(c)(i) Mobility 435

5.6.3(c)(ii) Activities of daily living 438

5.6.3(c)(iii) Social relationships 441

5.6.3(c)(iv) Activities as provider/supporter 445

5.6.3(d) Environment 449

5.6.3(d)(i) Opportunities for acquiring new information and skills 449

5.6.3(d)(ii) Health and social care: accessibility and quality 453

5.6.3(d)(iii) Participation in and opportunities for recreation/ leisure activities 456

5.6.3(d)(iv) Work satisfaction 459

5.7 Conclusion 463

CHAPTER 6 FINDING AND DISCUSSION 466

6.1 Introduction.....466

6.2 Angklung as a Therapeutic Medium for the Elderly in Technology-Assisted Care Facilities 466

6.2.1 Physical 468

6.2.2 Psychological 470

6.2.3 Level of Independence 473

6.2.4 Social Relationships 476

6.2.5 Environmental 478

6.3 Developing and Innovating Assistive Tool Angklung for Elderly 482

6.3.1 Aslung 482

6.3.1(a) Development of Aslung 482

6.3.2 Digital Visual Notation Conductor (DVNC).....486

6.3.2(a) Development of DVNC 486

6.4 Stakeholder Perspectives on Assistive Technology and Art-Based Interventions 490

6.4.1 Elderly Participants.....490

6.4.2 Caregivers 490

6.4.3 Health Professionals 491

6.4.4 Design Experts 492

6.5 Conclusion 492

CHAPTER 7 CONCLUSION AND RECOMMENDATION.....496

7.1 Introduction.....496

7.2 Summary of Research Findings 496

7.2.1 Suitability of Angklung for the Elderly 496

7.2.2 Improvement in Quality of Life 498

7.2.3 Technological Innovation in the Use of Angklung 501
7.3 Comersalization 503
7.4 Research Significance 506
7.4.1 Theoretical Implications 506
7.4.2 Practical Implications 509
7.5 Recommendations for Future Research 510
7.5.1 Extending the Scope of Study 511
7.5.2 Extended Research Setting and Sampling 511
7.5.3 In-depth Study on Sound Art Components 511
7.5.4 Strength and Limitation of Study 512
7.6 Conclusion 512
REFERENCES 515
APPENDICES
LIST PUBLICATIONS
AUTHORS PROFILE

LIST OF TABLES

Page

Table 1.1	Number of persons aged 65 years or over by geographic region, 2019 and 2050.	4
Table 1.2	Demographic indicators related to population ageing from World Population Prospects: The 2017 Revision focus on Southeast Asia and Malaysia.	4
Table 1.3	Disability Among the Elderly Based on NHMS 2023 in Malaysia.	6
Table 2.1	Angklung type of music in Indonesia.	27
Table 2.2	Description of angklung unit parts according to angklung manufacturers in Malaysia and Indonesia.	35
Table 2.3	Description of the main parts of the angklung unit according to angklung manufacturers in Malaysia and Indonesia	35
Table 2.4	Angklung Melody type information.	39
Table 2.5	Information on the type of escort angklung.	41
Table 2.6	Information on the type of accompanying angklung according to the number of tones.	42
Table 2.7	Difference between melodic angklung and accompaniment angklung.	42
Table 2.8	Information about small, medium and large angklung units.	43
Table 2.9	Numerical score.	45
Table 2.10	Description of how to play angklung musical instruments according to technique.	53
Table 2.11	Disability Among the Elderly Based on NHMS 2023 in Malaysia.	77
Table 2.12	Effects of Alzheimer's Disease towards visual functions.	82
Table 2.13	Literature matric art-based intervention angklung on elderly.	99
Table 2.14	Classification of assistive technology.	106
Table 2.15	Medium and high assistive technology.	107

Table 2.16 Literature matric assistive technology angklung as an art-based intervention angklung on elderly..... 114

Table 3.1 Techniques for involving users in the design and development process, adopted from Preece et al. (2002).....134

Table 3.2 Criteria develop Aslung. 150

Table 3.3 Criteria develop Digital Visual Notation Conductor. 150

Table 4.1 Overview of interviewed experts. 181

Table 4.2 Suggestion expert. 182

Table 4.3 Criteria play angklung. 189

Table 4.4 The proposed activities for the prototype development. 190

Table 4.5 Criteria develop Aslung. 192

Table 4.6 Ender-3 V2 Specifications. 194

Table 4.7 Criteria develop Digital Visual Notation Conductor. 196

Table 4.8 Expert for pre-design concept. 204

Table 4.9 Phase assessment technique. 212

Table 5.1 Overview of interviewed experts. 227

Table 5.2 Suggestion expert. 227

Table 5.3 ECAQ and MoCA test results of Shalis Care Center participants. 230

Table 5.4 ECAQ and MoCA test results of Caring Retirement Home Care participants.....233

Table 5.5 ECAQ and MoCA test results of Pusat Jagaan Damai Permai participants. 236

Table 5.6 Cognitive assessment of elderly individuals. 238

Table 5.7 Caregiver's demographics. 239

Table 5.8 Results from the interview for the nested sub-theme interactive.....242

Table 5.9 Results from the interview for the nested sub-theme design. 244

Table 5.10 Results from the interview for the nested sub-theme design. 247

Table 5.11 Results from the interview for the nested sub-theme material. 249

Table 5.12 Results from the interview for the nested sub-theme interactive.....251

Table 5.13 Results from the interview for the nested sub-theme content.....253

Table 5.14 Results from the interview for the nested sub-theme design. 255

Table 5.15 Results from the interview for the nested sub-theme design. 257

Table 5.16 Results from the interview for the nested sub-theme material. 259

Table 5.17 Results from the interview for the sub-theme sensory function. 263

Table 5.18 Results from the interview for the sub-theme positive feelings.....265

Table 5.19 Results from the interview for the sub-theme thinking, learning, memory and concentration. 266

Table 5.20 Results from the interview for the sub-theme mobility. 268

Table 5.21 Results from the interview for the sub-theme activities of daily living. 270

Table 5.22 Results from the interview for the sub-theme activities as provider/supporter. 272

Table 5.23 Results from the interview for the sub-theme an opportunity for acquiring new information and skills. 274

Table 5.24 Results from the interview for the sub-theme health and social care: accessibility and quality. 276

Table 5.25 Results from the interview for the sub-theme participation in and opportunities for recreation/ leisure activities. 277

Table 5.26 ECAQ and MoCA test results usability test of Pusat Jagaan Damai Permai participants. 280

Table 5.27 Analysis of Digital Visual Notation and Aslung used. 306

Table 5.28 ECAQ and MoCA test results usability test of Pusat Jagaan Damai Permai participants. 310

Table 5.29 Caregiver participated usability test interviewed. 310

Table 5.30 Usability test note of Pusat Jagaan Damai Permai participants. 311

Table 5.31 Second testing color notes “Happy Birthday” 312

Table 5.32 Results from the interview for the nested subtheme interactive.....322

Table 5.33 Results from the interview for the nested subtheme design. 323

Table 5.34 Results from the interview for the nested subtheme design. 324

Table 5.35 Results from the interview for the nested subtheme material. 325

Table 5.36 Results from the interview for the nested subtheme interactive.....327

Table 5.37 Results from the interview for the nested subtheme content. 328

Table 5.38 Results from the interview for the nested subtheme design. 329

Table 5.39 Results from the interview for the nested subtheme design. 330

Table 5.40 Results from the interview for the nested subtheme material. 332

Table 5.41 ECAQ and MoCA test results second testing of Pusat Jagaan Damai Permai participants. 334

Table 5.42 ECAQ and MoCA test results second testing of Pusat Jagaan Damai Permai participants. 355

Table 5.43 Caregiver participated second testing interviewed. 355

Table 5.44 Second Testing note of Pusat Jagaan Damai Permai participants. 356

Table 5.45 Second Testing color notes “Rasa Sayang” 357

Table 5.46 Caregiver participated second testing interviewed. 366

Table 5.47 Second testing note of Pusat Jagaan Damai Permai participants. 367

Table 5.48 Results from the interview for the nested subtheme functionality. 369

Table 5.49 Results from the interview for the nested subtheme functionality. 370

Table 5.50 Results from the interview for the nested subtheme acceptance. 372

Table 5.51 Results from the interview for the nested subtheme usefulness. 373

Table 5.52 Results from the interview for the nested subtheme acceptance. 375

Table 5.53 Results from the interview for the nested subtheme usefulness. 376

Table 5.54 Results from the interview for the nested subtheme functionality. 377

Table 5.55 Results from the interview for the nested subtheme functionality. 379

Table 5.56 Results from the interview for the sub-themes sensory functions. 381

Table 5.57 Results from the interview for the sub-themes sensory functions. 382

Table 5.58 Results from the interview for the sub-themes thinking, learning, memory, and concentration. 383

Table 5.59 Results from the interview for the sub-themes negative feelings. 384

Table 5.60 Results from the interview for the sub-themes mobility. 385

Table 5.61 Results from the interview for the sub-themes activities of daily living. 386

Table 5.62 Results from the interview for the sub-themes social support. 387

Table 5.63 Results from the interview for the sub-themes activities as providers/supporters. 388

Table 5.64 Results from the interview for the sub-themes opportunities for acquiring new information and skills. 389

Table 5.65 Results from the interview for the sub-themes health and social care: accessibility and quality. 389

Table 5.66 Results from the interview for the sub-themes participation in and opportunities for recreation and leisure activities. 391

Table 5.67 Results from the interview for the sub-themes work satisfaction. 392

Table 5.68 Results from the interview validation by expert for the subthemes hearing and nested subtheme functionality. 396

Table 5.69 Results from the interview validation by expert for the subthemes vision/sight nested subtheme functionality. 399

Table 5.70 Results from the interview validation by expert for the subthemes touch and nested subtheme acceptance. 403

Table 5.71 Results from the interview validation by expert for the nested subtheme usefulness. 407

Table 5.72 Results from the interview validation by expert for the nested subtheme acceptance. 411

Table 5.73 Results from the interview validation by expert for the nested subtheme usefulness. 414

Table 5.74 Results from the interview validation by expert for the nested subtheme functionality. 417

Table 5.75 Results from the interview validation by expert for the nested subtheme functionality. 420

Table 5.76 Results from the interview validation by expert for the sub-themes sensory functions. 424

Table 5.77 Results from the interview validation by expert for the sub-themes sensory functions. 427

Table 5.78 Results from the interview validation by expert for the sub-themes thinking, learning, memory, and concentration. 430

Table 5.79 Results from the interview validation by expert for the sub-themes negative feelings. 433

Table 5.80 Results from the interview validation by expert for the sub-themes mobility. 436

Table 5.81 Results from the interview validation by expert for the sub-themes activities of daily living. 440

Table 5.82 Results from the interview validation by expert for the sub-themes social support. 443

Table 5.83 Results from the interview validation by expert for the sub-themes activities as providers/supporters. 448

Table 5.84 Results from the interview validation by expert for the sub-themes opportunities for acquiring new information and skills. 451

Table 5.85 Results from the interview validation by expert for the sub-themes health and social care: accessibility and quality. 455

Table 5.86 Results from the interview validation by expert for the sub-themes participation in and opportunities for recreation and leisure activities. 458

Table 5.87 Results from the interview validation by expert for the sub-themes work satisfaction. 461

Table 6.1 Summarizes the integration of Angklung Healing Art Project therapy using the assistive tool, HarmonyGuide Assistek.....467

Table 6.2 Impact of HarmonyGuide Assistek on elderly. 482

LIST OF FIGURES

Page

Figure 1.1	Past, present and future trends of senior citizens, Malaysia 1960-2030. Source: Department of Statistics of Malaysia.	5
Figure 2.1	Angklung unit parts (i) 3-tube angklung unit, (ii) 2-tube angklung unit and (iii) angklung unit.	34
Figure 2.2	Pak Radja notation.	47
Figure 2.3	The technique of playing angklung.	52
Figure 2.4	Full Notation Guide, Pak Radja.	62
Figure 2.5	The same scene observed by different age groups (20, 40, 60 and 80 years old) by Margrain (2005).	81
Figure 2.6	Conceptual design framework.	122
Figure 3.1	Theoretical framework diagram	130
Figure 3.2	Activities of UCD, adopted from ISO 13407 G and S (1999).	133
Figure 3.3	The interrelationship between design principles that motivate a design project.	144
Figure 3.4	Research design framework.	145
Figure 3.5	Usability test method adaptation Ghunaim (2023).	154
Figure 3.6	Research workflow chart.	177
Figure 4.1	Keyboard Notation Happy Birthday.	184
Figure 4.2	Ideation Aslung	201
Figure 4.3	Design 3D Aslung.	202
Figure 4.4	Front view.	202
Figure 4.5	Back view.	202
Figure 4.6	Side view.	203
Figure 4.7	Top view.	203
Figure 4.8	Isometric view.	203
Figure 4.9	Process printing Aslung.	204

Figure 4.10 Aslung prototype. 205
Figure 4.11 All color Aslung prototype. 205
Figure 4.12 Aslung prototype on Angklung. 206
Figure 4.13 Testing Aslung on angklung. 206
Figure 4.14 Ideation Digital Visual Notation Conductor. 207
Figure 4.15 Original Notation “Happy Birthday” by Pak Radja. 207
Figure 4.16 Interface Song “Happy Birthday” by Digital Visual Notation Conductor. 208
Figure 4.17 Sound set up on Adobe Premier Pro. 210
Figure 4.18 Aslung on angklung different color. 215
Figure 4.19 Song “Rasa Sayang” by Pak Radja. 216
Figure 4.20 Song “Rasa Sayang” after modified. 217
Figure 4.21 Editing visual by Adobe Premier Pro. 217
Figure 4.22 Sound setting requirement on Adobe Premier Pro. 218
Figure 4.23 Interface Song “Rasa Sayang” by Digital Visual Notation Conductor. 219
Figure 5.1 Themes of Assistive Technology issue. 240
Figure 5.2 Themes Quality of Life Elderly. 261
Figure 5.3 Themes usability of HarmonyGuide Assistek. 320
Figure 5.4 Themes impact usability of HarmonyGuide Assistek. 367
Figure 5.5 Themes Quality of Life Elderly. 380
Figure 5.6 Graph score assessment by expert from hearing (functionality). 395
Figure 5.7 Graph score assessment by expert from vision/sight (functionality). 398
Figure 5.8 Graph score assessment by expert from touch (acceptance). 402
Figure 5.9 Graph score assessment by expert from touch (usefulness). 406
Figure 5.10 Graph score assessment by expert from cognitive function (acceptance). 410

Figure 5.11 Graph score assessment by expert from cognitive function (usefulness). 413

Figure 5.12 Graph score assessment by expert from cognitive function (functionality)..... 416

Figure 5.13 Graph score assessment by expert from psychomotor (functionality)..... 419

Figure 5.14 Graph score assessment by expert from physical (sensory function)..... 423

Figure 5.15 Graph score assessment by expert from psychological (positive feeling). 426

Figure 5.16 Graph score assessment by expert from psychological (thinking, learning, memory, and concentration). 429

Figure 5.17 Graph score assessment by expert from psychological (negative feeling)..... 432

Figure 5.18 Graph score assessment by expert from level of independence (Mobility). 435

Figure 5.19 Graph score assessment by expert from level of independence (activities of daily living)..... 439

Figure 5.20 Graph score assessment by expert from social relationships (social support)..... 442

Figure 5.21 Graph score assessment by expert from social relationships (activities as providers/supporters)..... 446

Figure 5.22 Graph score assessment by expert from environment (opportunities for acquiring new information and skills). 450

Figure 5.23 Graph score assessment by expert from environment (health and social care: accessibility and quality). 453

Figure 5.24 Graph score assessment by expert from environment (participation in and opportunities for recreation/ leisure activities)..... 457

Figure 5.25 Graph score assessment by expert from environment (work satisfaction). 460

LIST OF PLATES

Page

Plate 2.1	Angklung Melody found in Malaysia.	39
Plate 2.2	Angklung accompaniment available in Malaysia.	41
Plate 2.3	Pak Radja conduct student to play angklung.	62
Plate 2.4	List of books published by Pak Radja.	63
Plate 4.1	Set angklung.	183
Plate 4.2	Every part of different note.	183
Plate 4.3	Book Angklung Malaysia by Pak Radja.	184
Plate 4.4	Angklung by part note.	185
Plate 4.5	Design in Adobe Photoshop.	185
Plate 4.6	Notation with stand.	186
Plate 4.7	Notation with stand.	187
Plate 4.8	Autodesk Fusion 360.	193
Plate 4.9	Creality Ender-3 V2 3D Printer.	193
Plate 4.10	Material TPU filament.	196
Plate 4.11	Software Adobe Premier Pro.	197
Plate 4.12	Speaker JBL.	198
Plate 4.13	Projector Visual.	198
Plate 4.14	Screen Projector.	199
Plate 4.15	Projector stand.	200
Plate 4.16	Angklung different note.	213
Plate 4.17	Book Irama Angklung Volume 3.	214
Plate 5.1	Expert from music Angklung.	225
Plate 5.2	Expert from Hospital Universiti Sains Malaysia.	225
Plate 5.3	Expert from health.	226

Plate 5.4 Expert from eldercare institution. 226

Plate 5.5 Shalis Care Center. 228

Plate 5.6 Caring Retirement Home Care. 231

Plate 5.7 Pusat Jagaan Damai Permai. 234

Plate 5.8 Frame 1, caregiver instructing participant to shake angklung according to notation (Caring Retirement Home Care). 243

Plate 5.9 Frame 2, researcher explaining the visual notation displayed (Pusat Jagaan Damai Permai). 245

Plate 5.10 Frame 3, participant in wheelchair holding angklung at the Pusat Jagaan Damai Permai. 248

Plate 5.11 Frame 4, participants holding angklung (Pusat Jagaan Damai Permai). 250

Plate 5.12 Frame 5, caregiver helping participants shake angklung in turn (Caring Retirement Home Care). 252

Plate 5.13 Frame 6, caregiver explaining angklung notation to participants (Pusat Jagaan Damai Permai). 255

Plate 5.14 Frame 7, researcher giving instructions on song notation (Caring Retirement Home Care). 256

Plate 5.15 Frame 8, participant in wheelchair holding angklung at Pusat Jagaan Damai Permai. 258

Plate 5.16 Frame 9, participants holding angklung (Caring Retirement Home Care). 259

Plate 5.17 Frame 10, wheelchair participants can hold and shake angklung (Shalis Care Center). 264

Plate 5.18 Frame 11, participants happy to play angklung (Shalis Care Center). 265

Plate 5.19 Frame 12, researcher giving a lesson to participants (Caring Retirement Home Care). 267

Plate 5.20 Frame 13, participant holding angklung while looking at visual notation (Pusat Jagaan Damai Permai). 269

Plate 5.21 Frame 14, cheerful participants playing angklung (Shalis Care Center). 271

Plate 5.22 Frame 15, participants focused on researcher's explanation (Shalis Care Center). 273

Plate 5.23 Frame 16, participants receive new instructions on shaking angklung (Shalis Care Center). 275

Plate 5.24 Frame 17, angklung art intervention activities at Pusat Jagaan Damai Permai. 277

Plate 5.25 Frame 18, angklung art intervention at Pusat Jagaan Damai Permai. 278

Plate 5.26 Frame 19, elderly participants seated playing angklung at Pusat Jagaan Damai Permai. 282

Plate 5.27 Frame 20, elderly participants seated comfortably at Pusat Jagaan Damai Permai. 283

Plate 5.28 Frame 21, elderly participants grasp angklung, preparing to shake. 283

Plate 5.29 Frame 22, variety of elderly participants focused on DVNC. 284

Plate 5.30 Frame 23, participants in a row except female wheelchair users. 285

Plate 5.31 Frame 24, female and male participants laughing together. 285

Plate 5.32 Frame 25, participants look to each other for help. 286

Plate 5.33 Frame 26, two female participants focused on DVNC ahead..... 287

Plate 5.34 Frame 27, group of elderly participants focused on DVNC. 287

Plate 5.35 Frame 28, elderly male participants seated comfortably playing angklung. 288

Plate 5.36 Frame 29, elderly male on left focused on DVNC, right assisting others. 289

Plate 5.37 Frame 30, two female participants focused on DVNC while holding angklung. 289

Plate 5.38 Frame 31, female participants holding angklung with different grips. 290

Plate 5.39 Frame 32, group of participants engaged in Angklung Healing Art Project activities. 291

Plate 5.40 Frame 33, some participants focused, others watching friends. 291

Plate 5.41 Frame 34, two female participants look to assist friends. 292

Plate 5.42 Frame 35, participants focused ahead while holding angklung. 293

Plate 5.43 Frame 36, participants awaiting instructions from DVNC. 293

Plate 5.44 Frame 37, participants holding angklung in various colors. 294

Plate 5.45 Frame 38, participants seated, observing DVNC in various styles. 295

Plate 5.46 Frame 39, left participant happily playing angklung, others focused. 295

Plate 5.47 Frame 40, female participant in wheelchair holding angklung with one hand. 297

Plate 5.48 Frame 41, participants holding angklung with both hands. 298

Plate 5.49 Frame 42, participants awaiting turn to shake angklung. 298

Plate 5.50 Frame 43, female participants holding angklung with both hands. 299

Plate 5.51 Frame 44, female participants gripping angklung while observing DVNC. 300

Plate 5.52 Frame 45, seated participants holding angklung, awaiting turn. 300

Plate 5.53 Frame 46, participants observed peers to assist with instructions. 301

Plate 5.54 Frame 47, male participant holding angklung with one hand. 302

Plate 5.55 Frame 48, participants include those in wheelchairs, on couches, and in chairs. 302

Plate 5.56 Frame 49, male participants assist female participants in wheelchairs. 303

Plate 5.57 Frame 50, female participants shaking angklung in various positions. 304

Plate 5.58 Frame 51, female participants holding angklung observing the DVNC. 304

Plate 5.59 Frame 52, participants in a semicircle playing angklung. 305

Plate 5.60 Frame 53, male participants in sequential angklung performance. 312

Plate 5.61 Frame 54, participants listening and awaiting their turn. 313

Plate 5.62 Frame 55, participants in serious angklung performance. 314

Plate 5.63 Frame 56, participants in a dimly lit room. 314

Plate 5.64 Frame 57, participants with angklung observing friends and DVNC. 315

Plate 5.65 Frame 58, wheelchair participants holding angklung with one hand. 316

Plate 5.66 Frame 59, participants with angklung awaiting instructions. 317

Plate 5.67 Frame 60, focused participants happily observing instructions. 317

Plate 5.68 Frame 61, female wheelchair participants observing friends for their turn. 318

Plate 5.69 Frame 62, participants observing DVNC and assisting struggling friend in queue. 319

Plate 5.70 Frame 63, male and female participants in various styles waiting to play angklung. 320

Plate 5.71 Frame 64, group with facilitator in activity area at Pusat Jagaan Damai Permai. 336

Plate 5.72 Frame 65, wo female participants observing front and side of DVNC. 337

Plate 5.73 Frame 66, digital visual notation conductor with projector for group visibility. 338

Plate 5.74 Frame 67, group holding angklung, female participants dizzy from others' behavior. 338

Plate 5.75 Frame 68, group holding angklung, male participants laughing. 339

Plate 5.76 Frame 69, group holding angklung, some observing visuals, others watching to assist friends. 340

Plate 5.77 Frame 70, various styles of participants holding angklung, awaiting turn instructions. 340

Plate 5.78 Frame 71, participants can observe digital conductor facing forward or sideways. 341

Plate 5.79 Frame 72, participants exhibit various styles, some assisting by playing well while observing friends' turns. 342

Plate 5.80 Frame 73, group playing angklung, observing friends and digital conductor while holding instruments. 343

Plate 5.81 Frame 74, participants exhibit various behaviors, some focused, others relaxed. 343

Plate 5.82 Frame 75, group displaying various interests while observing visuals, some assisting friends. 344

Plate 5.83 Frame 76, participant's behavior deviates from standard phase. 345

Plate 5.84 Frame 77, group holding angklung observing DVNC. 346

Plate 5.85 Frame 78, group seated on chairs, sofas, and wheelchairs holding angklung. 347

Plate 5.86 Frame 79, participants assisting new players with turn and duration info. 348

Plate 5.87 Frame 80, group holding angklung in various styles. 349

Plate 5.88 Frame 81, participants observing in various styles, waiting for friend to play. 349

Plate 5.89 Frame 82, new female participant holding angklung upside down, left participant focusing on visuals. 350

Plate 5.90 Frame 83, female in middle shaking angklung. 351

Plate 5.91 Frame 84, middle participant on angklung shake sofa with others assisting. 351

Plate 5.92 Frame 85, female signaling stop to new angklung player. 352

Plate 5.93 Frame 86, participants playing angklung in various styles. 353

Plate 5.94 Frame 87, group with angklung, watching DVNC. 353

Plate 5.95 Frame 88, female participant in wheelchair with angklung, observing DVNC. 357

Plate 5.96 Frame 89, newcomers observed by seniors for assistance. 358

Plate 5.97 Frame 90, participants holding angklung, waiting in various styles. 359

Plate 5.98 Frame 91, participants with angklung behind projector; others watch and wait. 359

Plate 5.99 Frame 92, participants with emotions: happy, focused, serious. 360

Plate 5.100 Frame 93, male participant shaking angklung while others watch visuals. 361

Plate 5.101 Frame 94, women in wheelchairs shaking angklung with veiled women. 361

Plate 5.102 Frame 95, female participants instructing others in wheelchairs. 362

Plate 5.103 Frame 96, participants with angklung awaiting turn. 363

Plate 5.104 Frame 97, participants waiting to play. 363

Plate 5.105 Frame 98, hijabi participants perform with angklung. 364

Plate 5.106 Frame 99, female participants shaking angklung. 365

Plate 5.107 Frame 100, participants observing DVNC. 365

LIST OF ABBREVIATIONS

AAC	Augmentative and Alternative Communication
AAR	Asrenee Abdul Razak
AB	Asyraf Bakri
ADL	Activity of Daily Living
AMD	Age-related macular degeneration
AT	Assistive technology
BSI	British Standards Institute
BV	Bambusa vulgaris
CAD/CAM	Computer-aided design
CBT	Cognitive-behavioral therapy
CCTV	Closed-circuit television
CIDe	Certified Industrial Designer
CNC	Computer numerical control
DFA	Design for All
DFD	Design for Disability
DOSM	Department of Statistics Malaysia
DSLR	digital single-lens reflex
DVNC	Digital Visual Notation Conductor
ECAQ	Elderly Cognitive Assessment Questionnaire
GA	Gigantochloa atroviolacea
GATE	Global Cooperation on Assistive Technology
GS	Gigantochloa scortechinii
Hz	Hertz
ID	Inclusive Design
IED	Informal Expert Design

IEH	Informal Expert Health
IL	Informal Male
ILC	Informal Male Caregiver
IP	Informal Female
IPC	Informal Female Caregiver
ISO	International Organization for Standardization
KHz	Kilohertz
KPWKM	Kementerian Pembangunan Wanita, Keluarga Dan Masyarakat
KS	Kamal Sabran
MIDI	Music Instrument Digital interface
MMSE	Mini-Mental State Examination
MoCA	Montreal Cognitive Assessment
MRI	Magnetic resonance imaging
NHMS	National Health and Morbidity Survey
OCD	Obsessive compulsive disorder
PAWE	Pusat Aktiviti Warga Emas
PET	Positron emission tomography
QoL	Quality of life
RE	Rumah Ehsan
RTD	Research Through Design
RSK	Rumah Seri Kenangan
TPU	Thermoplastic polyurethane
TV	Televisyen
UCD	User Centered Design
UD	Universal Design
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization

UPWE	Unit Penyayang Warga Emas
USM	Universiti Sains Malaysia
UT	Usability Test
WHO	World Health Organization

LIST OF APPENDICES

Appendix A	Approval Ethic USM
Appendix B	Permission to Conduct Research at Care Center
Appendix C	Expert Invitation Letter
Appendix D	Consent Form
Appendix E	ECAQ and MoCA Form
Appendix F	Validation Questionnaire
Appendix G	Sample Transcript
Appendix H	Coverage News
Appendix I	Workshop Angklung Healing Art Project
Appendix J	Angklung at Bandung, Indonesia
Appendix K	Exhibition Angklung Project
Appendix L	Competition Awards
Appendix M	Talk about Angklung
Appendix N	Artist Angklung Soundscape
Appendix O	Album Angklung
Appendix P	Validation Expert Form

INTERVENSI INOVATIF PENJAGAAN WARGA EMAS BERDASARKAN ANGKLUNG: SATU KAJIAN KES DALAM PEMBINAAN ASLUNG DAN APLIKASI DIGITAL SEBAGAI ALAT BANTUAN

ABSTRAK

Angklung, sebuah alat muzik tradisional yang dikenali kerana manfaatnya dalam intervensi dan terapi, masih kurang digunakan di Malaysia walaupun berpotensi meningkatkan kesejahteraan warga emas. Dengan keperluan yang semakin meningkat untuk intervensi bukan farmakologi dalam penjagaan warga emas, kajian ini meneroka penggunaan Angklung sebagai alat terapi dalam kemudahan rawatan berasaskan teknologi. Objektif kajian ini termasuk (i) mengenal pasti bagaimana alat muzik seperti Angklung boleh digunakan sebagai medium terapi untuk warga emas dalam kemudahan rawatan berasaskan teknologi, (ii) menganalisis maklum balas daripada pesakit, penjaga, doktor, pemuzik, dan pembuat alat muzik mengenai penggunaan Angklung sebagai intervensi berasaskan seni, (iii) membangunkan dan memperkenalkan inovasi alat bantu seperti Aslung dan Digital Visual Notation Conductor (DVNC) untuk menjadikan Angklung lebih mesra pengguna bagi warga emas, dan (iv) mengesahkan keberkesanan alat bantu ini melalui ujian kebolehgunaan dengan menilai maklum balas pengguna, termasuk pesakit, penjaga, doktor, dan pakar rujukan, dalam aktiviti pemulihan warga emas di pusat jagaan. Pendekatan kualitatif digunakan dengan pemerhatian dan temu bual separa berstruktur di Shalis Care, Caring Retirement Home Care, dan Pusat Jagaan Damai Permai. Kajian kes utama di Pusat Jagaan Damai Permai melibatkan ujian kebolehgunaan bagi dua peranti utama: Aslung, alat ergonomik yang dibangunkan menggunakan teknologi Autodesk 3D Fusion dan percetakan 3D, dan DVNC, yang menawarkan isyarat visual masa nyata

untuk membimbing pengguna. Penemuan kajian mengesahkan bahawa Aslung dan DVNC, yang dibangunkan di bawah HarmonyGuide Assistek, secara signifikan meningkatkan kesejahteraan fizikal, psikologi, dan tahap kebergantungan warga emas melalui terapi Angklung. Aslung meningkatkan kebolehcapaian dengan mengurangkan ketegangan fizikal, manakala DVNC membantu rangsangan kognitif dengan menyediakan bimbingan muzik yang berstruktur. Projek Angklung Healing Art menunjukkan bahawa integrasi Angklung dengan teknologi bantuan mampu meningkatkan kualiti hidup warga emas, termasuk aspek fizikal, psikologi, hubungan sosial, tahap kebergantungan, dan kesejahteraan persekitaran. Integrasi ini menyokong mobiliti, rangsangan mental, dan autonomi, mengukuhkan keupayaan peserta untuk menjalankan aktiviti harian dengan lebih yakin. Kajian ini menekankan terapi muzik yang disokong oleh teknologi bantuan sebagai intervensi bukan farmakologi yang berkesan dalam penjagaan warga emas, memastikan pengalaman pemulihan yang holistik dan inklusif. Kesimpulannya, Aslung dan DVNC berjaya merapatkan jurang antara seni tradisional dan pemulihan moden, menyumbang kepada pendekatan yang inovatif dan relevan dari segi budaya dalam penjagaan kesihatan geriatrik.

INNOVATIVE ANGKLUNG BASED INTERVENTION FOR ELDERLY CARE: A CASE STUDY ON THE DEVELOPMENT OF ASLUNG AND DIGITAL APPLICATION AS ASSISTIVE TOOLS

ABSTRACT

Angklung, a traditional musical instrument known for its intervention and therapeutic benefits, remains underutilized in Malaysia despite its potential to enhance elderly well-being. With the growing need for non-pharmacological interventions, this study explores Angklung as a therapeutic tool within technology-assisted treatment facilities. The research objectives include (i) identifying how musical instruments such as Angklung can be used as a therapy medium for the elderly in technology-assisted treatment facilities, (ii) analyzing responses from patients, caregivers, doctors, musicians, and instrument makers regarding the use of Angklung as an art-based intervention, (iii) developing and innovating assistive tools such as Aslung and the Digital Visual Notation Conductor (DVNC) for Angklung musical instrument aids suitable for the elderly, and (iv) validating these assistive tools through usability tests by assessing user responses, including patients, caregivers, doctors, and referral experts, regarding their effectiveness in elderly rehabilitation activities in care centers. A qualitative approach was employed, incorporating observations and semi-structured interviews at Shalis Care, Caring Retirement Home Care, and Pusat Jagaan Damai Permai. A primary case study at Pusat Jagaan Damai Permai provided usability testing for two key devices: Aslung, an ergonomic aid created using Autodesk 3D Fusion and 3D printing technology, and DVNC, which offers real-time visual cues to guide users. Findings confirm that Aslung and DVNC, developed under HarmonyGuide Assistek, significantly enhance elderly participants' physical, psychological, and level of

independence through Angklung therapy. Aslung improves accessibility by reducing physical strain, while DVNC aids cognitive engagement by providing structured musical guidance. The Angklung Healing Art Project demonstrates that integrating Angklung with assistive technology improves the quality of life for elderly individuals by enhancing their physical, psychological, social relationships, level of independence, and environmental well-being. This integration fosters mobility, mental stimulation, and autonomy, reinforcing participants' ability to engage in daily activities with confidence. The study highlights music therapy, supported by assistive technology, as an effective non-pharmacological intervention in elderly care, ensuring a holistic and inclusive rehabilitation experience. Ultimately, Aslung and DVNC bridge the gap between traditional arts and modern rehabilitation, contributing to a culturally relevant and innovative approach in geriatric healthcare.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Arts in health, which may also be referred to as arts in medicine or healthcare arts cover a diverse range of practices that utilise art intentionally for changes and development within the field of health and healthcare applications (National Organisation for Arts Health, 2017). Art and healthcare lightning remain a field of research that is very open across disciplines, but with the common purpose of improving health care for people by creating relationships between art and human beings which are related to significant moments in life. Arts integration is a bourgeoning practice of using the arts in healthcare and community settings for therapeutic, educational or expressive outcomes (Goodman & Sims 2009).

Art in health is important because it demonstrates non-pharmacological healthcare treatments that pharmaceutical companies cannot make money from. Unfortunately, lack of awareness and knowledge about such treatment is still present in Malaysia situation (Mohd Bakri et al., 2022). Art forms such as music, literature, painting and dance are used in healthcare settings particularly hospitals and palliative care to alleviate suffering (pain/anxiety), aid healing process and improve overall patient experience stating that, several techniques have been shown positive effects on quantitative or qualitative outcome measures for patients health (Myore & Sims, 2009). Art is now shown to be very powerful, particularly with respect to participating in art as well as experiencing it. It contributes largely towards spiritual health and becomes a platform for individuals recovery. According to Armstrong (2021), art might promote healing and allow artists to connect with their communal contexts.

Background Non-pharmacological approaches in healthcare, such as those that incorporate non-drug treatment modalities target common goals of reducing fear and stress among patients El Geziry et al. (2018), allay pain or aim to give the patient a measure of control. Creative activities play an important role in some different ways which are they allow individuals to reflect their thoughts and emotions, are involved with self-understanding, have a deep interaction with biological psychological sociocultural context peers as well societal level community, develop significant relationships among them throughout the process.

Malaysia is a country with its own cultural heritage and identity (Ishak & Nassuruddin, 2014). Melody, harmony and rhythm all create the skeleton of this incredibly personal experience we call music; hence these 3 aspects determine cultural heritage among other things. Traditional musical instruments of Malaysia, such as angklung, bamboo musical instruments played by shaking, have been used in the country since many thousands years ago and are still utilized in various fields including farming events (Rosyadi 2012; Mohd Bakri et al., 2022).

Research indicates that the use of angklung music can increase quality of life for elderly folk sufferers by reducing loneliness and enhancing physical, psychological social impact on health science (Komariyah, 2016; Yudistira et al., 2014). In addition to musical activities, technology has shown promise in supporting elderly health as well; Smart Band technology boosting elderly participation in musical activities (Phoasavadi, 2022).

This is critically important if the Malaysian government wants to maintain and sustain high quality of life service provision in elderly care centers as Malaysia heads

towards an aging nation status by 2030 with larger proportion of population aged 65 years old and above (WHO, 2004; Amri, 2023; Department of Social Welfare, 2023).

In order to do so, it aimed at understanding the decreasing ability of elderly in playing angklung musical instruments and exploring a way that can help or make this ability better; also studied about the effects on them through Angklung as art interventions. This research is important because it incorporates the art and culture longed by traditional musical instruments into logistic practices and contributes to healthy elderly life at care centers. The research on angklung as well, will have an impact for assistive technology in angklung play accessible to all musicians and set the art-based intervention activities with using same musical instrument (angklung) into older age guidelines.

1.2 Problem Statement

People worldwide are living longer — on average, to their mid-sixties. Population ageing, the increased of age is a part on to the take over hand in side population. The age/sex pyramid is used by demographers to represent distribution of population after all ages (WHO, 2022). Projections: There'll be 1.4 billion people aged above 60, a sixth of the world population in year_2030 compared to one billion in millennium year 2002. There will be an estimated 2.1 billion people aged 60 years or over by the year 2050, alongside a tripling of those in their late eighties and beyond to reach around. The UN 2019 shows that the largest number of elderly will be in Eastern and Southern eastern Asia both in 2019 as well as in projected to come years 2050.

Table 1.1 Number of persons aged 65 years or over by geographic region, 2019 and 2050.

Region	Number of persons aged 65 or over in 2019 (millions)	Number of persons aged 65 or over in 2050 (millions)	Percentage change between 2019 and 2050
World	702.9	1548.9	120
Sub-Saharan Africa	31.9	101.4	218
Northern Africa and Western Asia	29.4	95.8	226
Central and Southern Asia	119.0	328.1	176
Eastern and South-Eastern Asia	260.6	572.5	120
Latin America and the Caribbean	56.4	144.6	156
Australia and New Zealand	4.8	8.8	84
Oceania, excluding Australia and New Zealand	0.5	1.5	190
Europe and Northern America	200.4	296.2	48

Sources: United Nations, Department of Economic and Social Affairs, Populations Division (2019). World Population Prospect 2019. *Excluding Australia and New Zealand.

Table 1.2 Demographic indicators related to population ageing from World Population Prospects: The 2017 Revision focus on Southeast Asia and Malaysia.

Demographic indicators related to population ageing from World Population Prospects: The 2017 Revision										
							Life expectancy at birth (years)		**Life expectancy at age 60 (years)**	
	Population aged 60 years or over (thousands)		**Percentage aged 60 years or over**		**Median age of the population (years)**		**Females**	**Males**	**Females**	**Males**
Country or area	2017	2050	2017	2050	2015	2050	2010- 2015		2010- 2015	
South-East Asia	63 973	167877	9.9	21.0	28.5	37.5	73.4	67.7	20.0	16.9
Malaysia	3074	9647	9.7	23.1	27.7	40.2	77.1	72.6	20.6	18.5

Sources: United Nations. Department of Economic and Social Affairs. Population Division. (2017). *World population ageing: 2017 highlights*. UN.

Malaysia is expected to become an elderly nation in 2030 when 15.3% of its population is over 60. Malaysia's old population will grow from 7.2% in 2022 to 7.4% in 2023, totalling 2.5 million individuals, according to the Department of Statistics Malaysia (DOSM). DOSM also predicted that in 2040, Malaysia would have 18.6% young and 14.5% old. Malaysia will have about 6.0 million elderly (Wan Ibrahim et al., 2023). Ageing is caused by molecular and cellular damage. This causes slow physical and mental deterioration, illness vulnerability, and death. Retirement and lifestyle changes effect ageing (WHO, 2022). Older age frequently brings hearing loss, cataracts, osteoarthritis, diabetes, and depression. Many causes may cause geriatric syndrome, including weakness, falls, urine incontinence, confusion, and pressure ulcers (WHO, 2022). The figure below depicts elderly citizen trends in Malaysia 1960–2030.

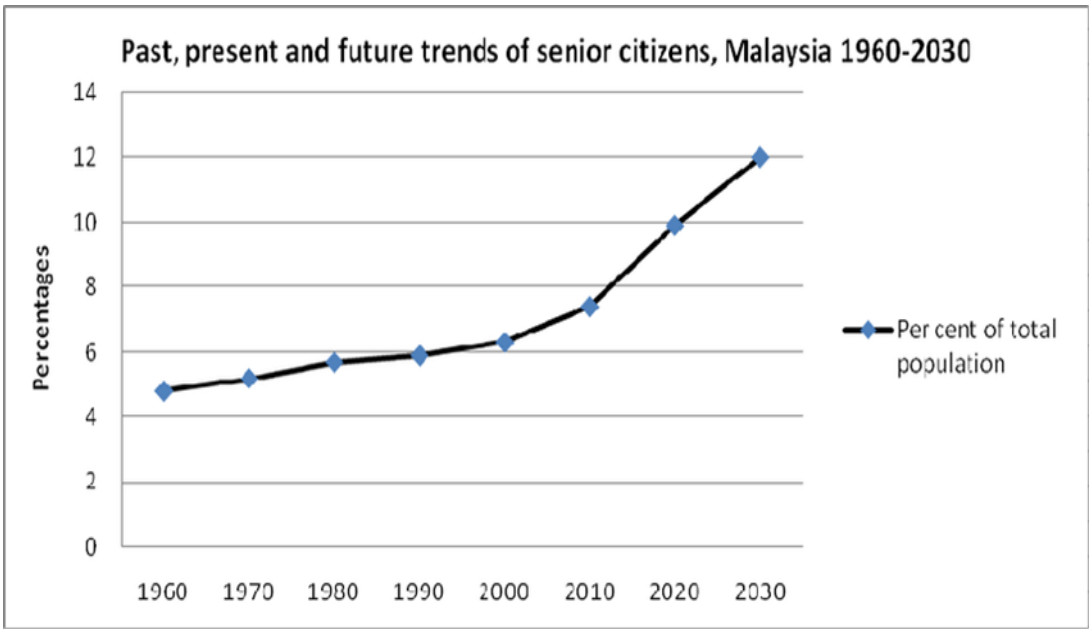

Figure 1.1 Past, present and future trends of senior citizens, Malaysia 1960-2030. Source: Department of Statistics of Malaysia.

The population is aging, and there are major healthcare demands from the elderly group particularly those above 60 years of age — with as high an outpatient services utilization rate of 16.3% for age-related health conditions according to the National Health and Morbidity Survey (NHMS) 2023. Of the elderly who utilise health facilities, public sector doctors see nearly half (48.9%), with private providers treating 51.1%. Access to care is available through public facilities, but they are followed by those in the private sector due to higher quality and expedited service delivery; unique clinics offering specialized geriatric services also marginally played a role. The elderly population is the most affected by disability, and that affects their demand of care and utilization. It noted that one in five Malaysian adults has lived with some functional limitations, indicating a large segment of society coping in life independently or without support (Public Health Institute, 2024). The survey identified several common types of disabilities among the elderly, as detailed in the table below:

Table 1.3 Disability Among the Elderly Based on NHMS 2023 in Malaysia.

Disability	Description
Visual Impairment	11% of the elderly experience difficulty seeing, even with visual aids. However, only 37% of those affected receive adequate assistance.
Hearing Impairment	3% of the elderly face difficulty hearing, despite using hearing aids, with only 26% receiving the necessary support.
Mobility Issues	10% of the elderly face challenges walking or climbing stairs, yet only 22% receive sufficient assistance. This highlights a significant gap in mobility aids and rehabilitation services.
Cognitive Impairment	7% of the elderly experience difficulties in remembering and concentrating, with only 6% receiving appropriate support. This indicates a critical need for cognitive support services.
Self-Care Difficulties	1.5% of the elderly have difficulty with self-care activities, such as bathing and dressing, with only 15% receiving assistance. This emphasizes the need to enhance care and support services.
Communication Challenges	1.8% of the elderly have difficulty communicating with others, and only 12% receive support. This suggests a need to improve communication tools and services.

Source: Public Health Institute (2024).

The multidisciplinary field of arts in healthcare, also known as arts in medicine, promotes health and medical services through art, involving literature, performing, visual, and creative arts in hospitals and communities (National Organisation for Arts in Health, 2017). These non-pharmacological therapies reduce patient fear, discomfort, anxiety, and pain, empowering patients and improving mental health (El Geziry et al., 2018; Grebe, 2019). The WHO (2023) found that art enhances well-being and motivates rehabilitation, emphasizing that quality of life is a complex, subjective evaluation involving physical, psychological, social, and environmental aspects (WHO, 2004).

The Angklung, a traditional bamboo musical instrument frequently showcased in Johor's kuda kepang dances and government events, is renowned for its lightweight structure and simplicity, making it an ideal instrument for elderly individuals, particularly those with sarcopenia (Mohd Bakri et al., 2021; Roubenoff, 2000). Unique among musical instruments, the Angklung requires no prior musical experience and produces one distinct note per instrument (Wahono, 2010). In Malaysia, the instrument enjoys widespread popularity across various age groups and abilities, including children, the elderly, and individuals with disabilities, due to its accessibility and educational benefits (Abdullah, 2022). However, playing the Angklung effectively involves several cognitive and sensory-motor processes, including watching (interpreting visual notation), hearing (listening to conductor instructions), and tactile engagement (holding and shaking the instrument). These tasks may pose challenges for the elderly, who often experience cognitive and sensory-motor declines, such as slower information processing, impaired decision-making, reduced cognitive speed, memory difficulties, and diminished executive functioning (Sumiyati, 2021; Raja Adnan, 2022; Abdullah, 2022). Addressing these challenges is essential to enhancing

the accessibility and therapeutic potential of the Angklung for elderly users, enabling greater participation and enjoyment in cultural and social activities.

Physical activity among the elderly is a pressing concern in Malaysia, where sedentary lifestyles and inactivity contribute to increased demand for eldercare (Liu et al., 2019; Public Health Institute, 2024). Mental health challenges such as loneliness and depression further highlight the need for innovative aged care strategies, with Angklung music activities offering a unique way to enhance the elderly's quality of life (Raja Adnan, 2022; Abdullah, 2023). The Malaysian way of playing Angklung is particularly suitable for elderly participants due to its structured, accessible techniques. This method emphasizes the use of visible notation numbers displayed behind the conductor, allowing performers to follow tempo and note sequences with ease, making it ideal for those with limited musical training or diminished cognitive and sensory-motor abilities. Unlike the Indonesian signal-based approach, which relies on subtle conductor cues that may be challenging for older players to interpret, the Malaysian system supports inclusivity by simplifying instructions and enhancing clarity. Additionally, it focuses on avoiding hand placement on the Angklung's voice box to preserve sound quality, encouraging sensitivity in handling the instrument. Elderly participants may need targeted training to master this method, ensuring they can fully engage with the activity while improving their cognitive, sensory, and motor skills. This tailored approach makes the Malaysian Angklung system an excellent tool for fostering social connection and promoting active, joyful participation among the elderly (Raja Adnan, 2022; Abdullah, 2023).

An assistive tool, also known as assistive technology (AT), encompasses products, equipment, and systems that enhance learning, working, and daily living for individuals with disabilities (Assistive Technology Industry Association, n.d.). The

integration of Angklung activities has been shown to enhance cognitive, psychomotor, and sensory skills, making it an effective intervention to improve the quality of life for elderly residents in care centers (Wattanasoei, 2016; Raja Adnan, 2022). Similarly, assistive tools such as the "Angklung Smart Band" and related technologies have demonstrated their ability to promote independence and cognitive engagement among the elderly. These assistive technologies function as important tools in enhancing the physical and cognitive experiences of elderly individuals through musical activities. However, despite these promising outcomes, the successful implementation of such assistive tools faces significant challenges. Research indicates that, while these technologies hold potential, their adoption requires addressing both cultural and technological barriers (Cooharojananone et al., 2022; Hiranpanthaporn et al., 2022; Phoasavadi, 2022). Compared to traditional therapeutic methods or other assistive technologies, the effectiveness of Angklung-based tools depends on addressing cultural and technological barriers. To maximize long-term benefits, it is essential to develop strategies that ensure cultural appropriateness and technological compatibility in elderly care practices. While Angklung practices differ between Malaysia and Indonesia, both focus on enhancing comfort and sound accuracy, making it a valuable tool for elderly care across cultures (Abdullah, 2022). Studies in Indonesia (Komariah, 2016), Singapore (Esplanade, 2017), and Thailand (Phoasavadi, 2022) have demonstrated Angklung's positive impact on improving the quality of life for elderly residents in care centers. Additionally, Malaysian Angklung practitioner Raja Adnan (2022) has endorsed Angklung as suitable for the elderly, based on his experience conducting activities with older adults in Malaysia.

In conclusion, Angklung training has demonstrated its potential to improve the physical and mental well-being of elderly individuals, as evidenced by its successful

implementation as a therapeutic tool in countries such as Indonesia, Singapore, and Thailand (Komariah, 2016; Esplanade, 2017; Phoasavadi, 2022). Its unique characteristics, such as accessibility, simplicity, and therapeutic value, make Angklung an excellent medium of artistic intervention for the elderly. However, the elderly in Malaysia face significant obstacles in playing Angklung due to age-related cognitive, sensory, and physical limitations. These challenges necessitate the development of assistive technologies and ergonomic tools to facilitate Angklung learning and performance. For instance, integrating digital technology, such as simplified notation systems and enhanced practice environments, could greatly enhance the accessibility of Angklung for elderly users. This research will address the gaps in current practices by proposing innovative solutions to support Angklung as a therapeutic medium for the elderly. Ultimately, these efforts aim to provide new treatment options, improve the quality of life for elderly individuals, and inform government strategies to prepare for Malaysia's aging population by 2030.

1.3 Background of Study

The field of art in healthcare, also known as art in medicine, involves various disciplines aimed at using art to enhance healthcare experiences by fostering meaningful connections during significant life moments. The integration of art in healthcare and communities is growing, incorporating literature, performing arts, visual arts, and design for therapeutic, educational, and expressive purposes (Goodman & Sims, 2009; National Organisation for Arts in Health, 2017). Non-pharmacological treatments, like arts-based therapies, are crucial as they reduce fear, anxiety, and pain without relying on medication, but awareness and application in Malaysia remain limited (Mohd Bakri & Sabran, 2022).

Art plays a vital role in healthcare settings, especially in hospitals and palliative care, to reduce pain and enhance the overall care experience, contributing significantly to patient well-being and recovery (Goodman & Sims, 2009). According to Armstrong (2021) and WHO (2023), art taps into natural healing potentials, aiding community integration and improving quality of life, which encompasses physical, psychological, social, and environmental well-being (WHO, 2004).

Angklung, a traditional bamboo musical instrument, is popular in Malaysia, particularly in Johor, and is used for various purposes including healthcare. It is ideal for the elderly due to its lightweight and simple playing method, making it accessible even for those with limited physical abilities (Roubenoff, 2000; Mohd Bakri et al., 2021). Angklung's therapeutic potential has been shown to improve the quality of life for the elderly, reducing loneliness and enhancing physical, psychological, and social well-being (Yudistira et al., 2011; Komariyah, 2016). In Malaysia, the playing techniques and musical notation for Angklung are slightly different from those in Indonesia, focusing on comfort and sound accuracy without the need for complex markers. This makes it more accessible to diverse groups, including children, adults, and those with disabilities (Abdullah, 2022).

The study aims to understand the decline in Angklung-playing abilities among the elderly and explore ways to enhance this skill through art-based interventions. Declines in sensory, cognitive, and physical functions among elderly individuals are well-documented in Malaysia, as reported by the National Health and Morbidity Survey (NHMS) 2023. For instance, 11% of elderly individuals face visual impairments, yet only 37% receive adequate assistance, while 3% experience hearing difficulties, with merely 26% receiving the necessary support. Mobility issues affect 10% of the elderly population, but only 22% benefit from rehabilitation or mobility

aids. Cognitive impairments, such as difficulties in memory and concentration, impact 7%, though just 6% receive appropriate cognitive support. Additionally, self-care difficulties and communication challenges affect 1.5% and 1.8% of the elderly, respectively, with low levels of assistance provided (Public Health Institute, 2024). These challenges highlight the need for innovative solutions to address declining abilities. This research integrates traditional musical instruments with technological innovations to develop assistive Angklung technologies that cater to the needs of elderly individuals in care centers. By addressing sensory, cognitive, and motor limitations, these interventions aim to enhance the health, well-being, and artistic participation of elderly residents, ultimately benefiting all musicians who face similar challenges.

Telerehabilitation has revolutionized elderly care by enabling remote rehabilitation services through digital platforms, improving accessibility, engagement, and functional recovery while reducing the need for hospital visits (Smith et al., 2020). The integration of wearable devices and sensor technology further enhances telerehabilitation by providing real-time monitoring of mobility, vital signs, and physical activity through tools such as smartwatches, accelerometers, and biosensors (Jones & Lee, 2021). These devices offer real-time feedback, detect movement abnormalities, and personalize rehabilitation exercises, ensuring better adherence and improved recovery outcomes (Wang et al., 2019). Additionally, AI-powered wearables can predict health risks, issue alerts, and assist caregivers in preventing falls and complications, thereby promoting independent living and reducing healthcare costs (Kim et al., 2022). A unique application of telerehabilitation with wearable technology is its potential to support elderly participation in activities such as Angklung games, which require coordinated hand movements to play tuned bamboo instruments

(Suryadi et al., 2023). This innovative approach not only enhances physical rehabilitation but also fosters social engagement and cultural participation among older adults.

In conclusion, this study underscores the pressing need for assistive tools that integrate traditional arts with modern technology to address the sensory, cognitive, and physical challenges faced by the elderly. These tools must prioritize accessibility, ease of use, and adaptability, creating platforms that provide therapeutic, educational, and monitoring capabilities tailored to the needs of elderly individuals with declining abilities. By bridging cultural heritage and technological innovation, such solutions can enhance participation, improve well-being, and reduce barriers to healthcare access, particularly for those in care centers or with limited mobility. Future advancements should emphasize ergonomic design, user-friendly interfaces, and inclusivity to ensure these interventions are effective for diverse populations. Additionally, incorporating features that promote independence, strengthen engagement, and provide therapeutic benefits would foster a holistic approach to elderly care. This research serves as a foundation for sustainable non-pharmacological interventions, demonstrating how the fusion of traditional art and technology can enhance the quality of life for the elderly while preserving cultural significance in a rapidly evolving healthcare landscape.

1.4 Research Aims

The aim of this study is to develop an assistive technology tool for the Angklung game to support elderly individuals experiencing physical, level of independence and psychological and to evaluate its impact on their quality of life in care centers.

1.5 Research Questions

i) What current solutions (design and technology) will be adopted as an alternative angklung application aid for the elderly?

ii) How to conceptualize the help of a new angklung application considering the previous one that works?

iii) How to evaluate the proposed design of angklung application assistance so that it can be realized in the real world?

1.6 Research Objectives

i) To identify musical instruments such as Angklung can be used as a therapy medium for the elderly in technology-assisted treatment facilities.

ii) To analyze responses use musical instruments such as the Angklung of respondents as an art-based intervention (patients, caregivers, doctors, musician, and makers)

iii) To develop and innovate assistive tools such as Aslung and DVNC for Angklung musical instrument aids suitable for the elderly.

iv) To validate using Usabilty Test with user and responses of respondents (patients, caregivers, and doctors) as well as (Referral Experts) about the ability of assistive tools and the potential of Angklung as an art-based intervention to assist in the rehabilitation activities of the elderly in care centers.

1.7 Scope of the Study

This study was conducted on elderly residents from a care center, Shalis Care Cenre, Kelantan, Caring Retirement Home Care, Penang and Pusat Jagaan Damai Permai, Penang, with the purpose to design and implement an innovative assistive device integrated Angklung as artistic intervention. Our main aim is to improve the quality of life for mild-to-moderate end-users. The survey is based on the willingness of seniors to volunteer, with assistance from participants and nurses in terms of feedback as well as data validation by experts in health design team and geriatric specialists.

This research focuses on the development of Angklung as an assistive technology, and its implementation in healthcare facilities through art-based intervention with particular requirements and disabilities. Through Angklung, the elderly can express themselves and their creativity as well socialize within thanks of this community-like form. In addition to the auditory stimulation, people benefit from music therapy— resulting in a better mood and an improved memory while having fun with the Angklung.

This study will highlight the unique innovation of Angklung playing with Malaysian approach and local techniques in order to offer a sense of culture sensitivity, awareness as well as applicable experiences among elder people therefore foster pride civilization integration. This requires the line of assistive technology solutions to be integrated with art-based interventions for elderly, supporting specific requirements and responses towards delivering well-being and social inclusion.

The results of numerous studies speak to the benefits of using art and music interventions, which include increased medication adherence rates as well as improved

mental health outcomes—specifically feelings such stress reduction—and perceived overall quality-of-life factors. The role of assistive technology is dynamic in healthcare, as evidenced by this study that allows those with physical disabilities or restrictions to experience an increased level of independence.

It also includes an examination of some cutting-edge technology solutions — assistive game devices and visually-appealing tech stuff that will support elderly healthcare closely. These provide cognitive stimulation suited for elders.

Conversely, we showed that Angklung can be used as both an assistive technology and intervention of visual art in the care facility setting to improve elderly healthcare well-being.

1.8 Significant of the Study

The integration of arts into healthcare and community settings, known as arts in health or arts in medicine, is increasingly recognized for its therapeutic, educational, and expressive benefits. This interdisciplinary approach enhances the healthcare journey by fostering meaningful connections between individuals and art. In this context, the development of an assistive technology tool for Angklung as an art-based intervention for elderly individuals in healthcare facilities carries significant implications across academic, industrial, governmental, and societal sectors.

From an academic standpoint, this study is particularly valuable as it pioneers the use of Angklung as an assistive technology in Malaysia, contributing to the fields of assistive technology and art-based interventions for the elderly. It offers new guidelines for researchers and demonstrates how art-based assistive technology can

improve the quality of life and well-being of elderly individuals, laying a solid foundation for future research.

In the industrial sector, the Angklung tool can drive the development of new assistive technologies and art-based interventions, potentially marketed as an interactive therapeutic device for care centers. This innovation not only enhances the quality of life for residents but also expands the market for assistive technology products. In the industrial sector, the development of innovative assistive technologies inspired by traditional tools like Angklung has the potential to address the physical and cognitive challenges faced by the elderly. Telerehabilitation (TR), which leverages technology to provide remote rehabilitation services such as physiotherapy, speech therapy, and occupational therapy, has emerged as a valuable solution for elderly individuals with limited access to in-person care. TR enables therapy to be delivered in the comfort of the patient's home, reducing barriers like cost, travel, and geographic constraints, while also fostering long-term adherence to rehabilitation programs (Başer Seçer, 2022). Integrating traditional cultural elements with telerehabilitation platforms could create interactive therapeutic devices for care centers, enhancing accessibility and usability for elderly users. Such innovations not only improve the quality of life by addressing physical, cognitive, and emotional needs but also pave the way for expanding the assistive technology market, blending cultural heritage with modern healthcare solutions.

For the government, the Angklung tool aligns with Malaysia’s aging plan, supporting initiatives for ambient assisted living and elderly healthcare solutions. Malaysia has established policies and strategies in line with the United Nations’ declaration of 2021–2030 as the Decade of Healthy Ageing, aiming to improve and strengthen the health and well-being of elderly individuals. While there is a growing

number of elderly care facilities in Malaysia, awareness about these facilities remains low, particularly in rural areas, where many elderly individuals are unaware of available resources. Additionally, limited resources pose significant challenges to promoting healthy aging and addressing the needs of an aging population. The adoption of assistive technologies, such as the Angklung tool, can enhance the quality of life for the elderly by fostering holistic and non-pharmacological care solutions. These technologies not only reduce healthcare costs but also support the government's efforts to prepare for the "silver tsunami," ensuring that Malaysia is equipped to address the challenges of an aging society (Abdullah, Ismail, & Yusoff, 2024).

Socially, this study highlights the importance of health and cultural preservation. The Angklung tool not only promotes the well-being of the elderly but also fosters cultural appreciation and intergenerational interaction, strengthening social bonds within the community.

In conclusion, the development of an assistive tool for Angklung tailored to the needs of the elderly presents a significant opportunity to enhance their quality of life through art-based interventions. Such a tool has the potential to address the sensory, cognitive, and motor challenges faced by elderly individuals, enabling greater accessibility and participation in cultural and therapeutic activities. By integrating traditional art forms with modern assistive technologies, this innovation can improve the physical, emotional, and social well-being of the elderly, fostering inclusivity and reducing isolation. Furthermore, it holds substantial implications across multiple sectors: advancing academic research in geriatric care, driving industry innovation in the creation of accessible and user-friendly devices, informing government policies aimed at healthy aging, and enriching societal well-being through the preservation and adaptation of cultural heritage. Ultimately, this initiative supports Malaysia's efforts

to address the needs of its aging population while promoting sustainable and holistic healthcare solutions.

1.9 Limitation of The Study

The study on the development of assistive technology for Angklung as an art-based intervention for the elderly in healthcare facilities identifies several critical limitations. Key challenges include the usability and acceptance of digital devices by the elderly, especially those with severe disabilities, which hinders the effective use of such technology in home environments. Concerns about data privacy and security in health monitoring further complicate the integration of smart technology.

The study also points out motivational barriers and skepticism among the elderly, particularly in the context of telerehabilitation for neurological diseases. This highlights the need for user-friendly interfaces and comprehensive training programs to build confidence and facilitate technology adoption.

Financial constraints are another significant hurdle, as the cost of smart technology limits the ability to produce high-quality prototypes and implement them in care centers. The scarcity of materials like thermoplastic polyurethane (TPU) and the lack of essential equipment further exacerbate these challenges.

Additionally, logistical issues, such as the considerable distance between researchers and study locations, poor cooperation from care centers, and limited participant availability, further impact the study's outcomes. Environmental barriers, such as inadequate facilities for conducting activities and the limited involvement of care center staff, also hinder the implementation of the study.

In conclusion, the study underscores the importance of addressing these limitations, including usability, data privacy, motivational factors, financial constraints, and environmental barriers, to successfully implement Angklung as an art-based intervention for the elderly in healthcare settings.

1.10 Structure of The Thesis

Chapter 1: Introduction

This first chapter is a base for your thesis where you present the topic and significance of research. The opening paragraph lays out the breadth of the field and its significance in academia. Next, this chapter discusses the research problem which is investigated in specific detail by explaining holes or shortcomings in literature that have been studied. Objectives to steer you into the research process by setting out what the study aims to achieve and examples of good practice. This section also provides an explanation of scope and limitations regarding the research itself, to define what falls out- or inside this specific study. Last, the chapter underlines why this study is relevant and gives an impression of how the thesis works.

Chapter 2: Literature Review

The literature review chapter critically examines existing works related to the research topic, providing a comprehensive overview of the theoretical and empirical landscape. It begins by contextualizing the research within the broader academic discourse, identifying key themes, concepts, and theoretical frameworks. This chapter systematically reviews relevant literature, synthesizing findings from previous studies to identify patterns, trends, and gaps in knowledge. A critical analysis and synthesis of the literature are used to assess the strengths and weaknesses of existing research,

aiding in the development of research questions and hypotheses. The literature review chapter concludes by summarizing the main findings and establishing a theoretical framework to guide subsequent chapters of the thesis.

Chapter 3: Methodology

The method chapter describes the research design, process and procedures that has been applied to answer problems raised in questions. This is followed by an abstract that indicates the philosophical perspective and theory underpinning the inquiry. This chapter then explains the research strategy, detailing the reason for selecting applied qualitative methodology. Robust descriptions of data collection and sampling techniques, and the ways in which analysis will be handled are given; ensuring transparency and robustness across the research process. They also discuss ethical issues, such as obtaining consent from participants and maintaining the confidentiality of data. The chapter on methodology ends with explanation of the pragmatism used in this study along evidence for triangulation to enrich full scope of research and increase reliability, validity.

Chapter 4: Prototype Development

The prototype development chapter focuses on the creation and implementation of a prototype or experimental intervention, if applicable. It begins by providing background information on the rationale for developing the prototype and its intended purpose within the research context. Detailed descriptions of the design process, including conceptualization, iteration, and refinement, are provided. This chapter outlines the technical specifications and functionality of the prototype, highlighting key features and components. Prototyping methodologies, such as iterative design, user-centered design, or agile development, may be discussed.

Challenges encountered during the development process and strategies to overcome them are also addressed. The chapter concludes by presenting the final prototype and outlining plans for its evaluation in subsequent chapters.

Chapter 5: Data Analysis and Interpretation

This chapter provides a comprehensive overview of the data collection, analysis, and interpretation processes employed in this study, beginning with a discussion of the research context and setting, including the population of interest and sampling strategies used to gather primary data. The data collection procedures are described in detail, outlining the instruments and tools utilized, such as questionnaires, interviews, observations, and experiments, while ethical considerations, including informed consent, confidentiality, and data protection measures, are thoroughly addressed to ensure compliance with research ethics. Following data collection, the analytical framework applied for data interpretation is elaborated, incorporating thematic analysis, image textual analysis, content analysis, and statistical techniques. The findings are structured according to the research objectives or themes identified in the literature review, ensuring clarity and coherence, with key findings presented through detailed descriptions supported by relevant data excerpts and visual representations, such as tables, charts, and graphs, to illustrate patterns, trends, and relationships within the dataset. Additionally, unexpected or contradictory findings are discussed, critically analyzing potential gaps, inconsistencies, and alternative interpretations, while strengths and limitations of the research methodology are examined to provide a balanced evaluation of the study. The chapter concludes by reflecting on the broader implications of the findings for theory, practice, and future research, offering insights into how the integration of assistive technology and art-based interventions can enhance therapeutic outcomes in elderly care settings.

Chapter 6: Findings and Discussion

The results and findings chapter presents the outcomes of the data analysis, providing a detailed summary of the main findings and discoveries. It begins by presenting descriptive statistics or summary measures to characterize the sample and variables studied. This chapter then presents the key findings of the study, organized according to the research objectives or themes identified in the literature review. Each finding is accompanied by relevant data excerpts or visual representations, such as tables, charts, or graphs, to enhance clarity and understanding. This chapter provides a comprehensive interpretation of the results, discussing their implications for theory, practice, and future research. Strengths, weaknesses, and areas for further investigation are also discussed.

Chapter 7: Conclusion and Recommendations

The conclusion and recommendations chapter synthesizes the main findings of the thesis and offers insights into their broader implications. It begins by summarizing the main findings and contributions of the research study, emphasizing how they address the research problem and objectives outlined in the introduction chapter. This chapter then discusses the theoretical and practical implications of the findings, identifying their significance for academia, industry, and society as a whole. Recommendations for future research are provided, outlining areas for further investigation and potential avenues for advancing knowledge in the field. The chapter concludes by reflecting on the overall research journey and offering final thoughts on the importance of the study and its contribution to the broader body of knowledge.

1.11 Conclusion

In conclusion, Chapter 1 establishes the importance of integrating the traditional Angklung musical instrument into healthcare as a non-pharmacological intervention for the elderly, particularly in Malaysia, where aging populations face physical, cognitive, and sensory challenges. This research explores the therapeutic potential of Angklung and aims to develop innovative assistive technologies to enhance accessibility, participation, and well-being in elderly care. By bridging cultural heritage with modern technology, the study seeks to improve quality of life, support healthy aging policies, and promote cultural preservation. The findings are expected to contribute to academic, industrial, governmental, and societal advancements, offering sustainable and inclusive healthcare solutions for Malaysia's aging population.