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Living and Learning in Dignity – Home, Apartment and School Design

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Book's Synopsis

Accessible homes and schools are important for the citizens (including people with disability, senior citizens, pregnant mothers, and so on). Considering this phenomenon, our Service-Learning Inclusive Design Course attempts to redesign an accessible and proper House and School for YPAB, YPAC, BILIC, Kampung Bratang and Jalan Bibis. This activity was conducted in collaboration with YPAB (Yayasan Pendidikan Anak Buta), YPAC (Yayasan Pembinaan Anak Cacat), BILIC (Bandung Independent Living Center), and other resource persons.

Home and school design is unique because every user owns specific disability spectrum. We intentionally chose the various disability spectrums to describe the differences between universal design and inclusive design. Inclusive design is defined as "the design of mainstream product and/or services that are accessible to and usable by as many people as reasonably possible[2]. The design is produced holistically by considering all spectrums of the users. The users are involved in the designing process. This feature slightly differentiates inclusive design from universal design. Universal design serves as standard design that attempts to accommodate a broad-spectrum of architectural ideas to produce buildings, products, and environments that are accessible to both people with and without disabilities. Based on this reason, we intend to explore more about inclusive design.

As a course, this activity consists of several phases, including lectures on 'Home and School Design for All Users', literature reviews, direct observations and licensing, interviews, and documentations, proposing accessible design, design workshops, design completion and final report. The activities have accommodated the inclusive design process.

The processes above are expected to propose accessible House and School designs which accommodate users' needs and local habits. The five designs discussed in this book are initial steps which are expected to serve as reference for the Government, private institutions, and society to provide more accessible and proper facilities for all (including disabled people and people with special needs). Finally, the writers hope this book would inspire other people with special needs to independently design proper accessible House and School in their life.

Preface

First, we thank God Almighty for the opportunity given to be able to prepare an interesting book I also thank My family, which are Dr. Ir. Joyce M. Widjaya, M.T., Priskila Adiasih, S.E., M.Sc., Katrina, and Gunadi Tanuwidjaja, B.A.Sc., ACCA. for relentless support. This book was produced from the results of an exploration using the University Network Digital (Local) Knowledge method in the C Service Work Course - Inclusion Design course. The result of the exploration was developed into SERVICE LEARNING for the community, or it was known later as UNDK-SL. So, this book is considered providing enlightenment to Architecture Students, Professional Architects, and the public regarding Inclusive Design.

We appreciate the support of Dr. Rudy Setiawan, S.T., M.T. (current Dean of the Faculty of Civil Engineering and Planning / FTSP), Timoticin Kwanda, B.Sc., MRP., Ph.D. (Dean of FTSP 2014-2017) and Ir. Handoko Sugiarto, M.T. (Dean of FTSP 2009-2014) for facilitating collaborations with external parties.

Appreciations are given to Dr. Agus Dwi Hariyanto, S.T., M.Sc., the Head of the Architecture Study Program (2009-2013); Mrs. Eunike Kristi Julistiono, S.T., M.Des.Sc. (Hons.) Ph.D. Cand., the Head of the Architecture Study Program (2014-2017); and Prof. Ir. Lilianny Sigit Arifin, M.Sc., Ph.D. as the current Head of the Architecture Study Program for the support given in this SERVICE-LEARNING course over the past few years. So that we can be creative in this subject and serve the people who live in limitations around us.

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all our workshops, fundraisings, exhibitions, and campaigns. We also thank the participants of the Inclusive Design Course and the KKP-C Inclusive Design Course who have supported this activity since 2012. We believe that this course equips students in producing designs that pay more attention to users with special needs.

We want to thank the Yayasan Pendidikan Anak Buta (YPAB/ Blind Child Education Foundation), especially fellow teachers at Special Junior High School Type A YPAB such as: Drs. Eko Purwanto, Mohamad Ali Muhaidhori, M.Pd., Mochamad Ryan Syuhadi, M.Pd., Saif Ali Akbar Sadewo, S.Pd., Hersiwi Kustandyah, S.Pd., Riski Nurilawati, S.Pd., Djoko Sudiro, Umi Sa'adah, S.Ag., MSI, Tutus Setiawan, M.Pd., Dwi Rahmawati, S.Pd., Atung Yunarto, M.Pd., Desutandry Nasofti Martha, M.Pd. and (the Late) Madoeri. We also thank Yayasan Pendidikan Anak Cacat (YPAC/ Education Foundation for Children with Disabilities, Bandung Independent Living Center (BILIC).

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Surabaya, 01 March 2021

Gunawan Tanuwidjaja ST. MSc.
on behalf of the Team

Table of Contents

Writers 2
Book's Synopsis 3
Preface 4
Table of Contents 6
List of Figures 7
List of Tables 12
Introduction by Dean of Engineering and Planning Faculty, Petra Christian University 13
Introduction by Head of Architecture Study Program, Petra Christian University 14
Chapter 1. Introduction 15
Chapter 2. Literary Review 18
Chapter 3. Inclusive Design Process in the Book 21
Chapter 4. A New Concept of Inclusive Design 30
4.1. Cerebral Palsy Friendly Home Design for Mr. Ahmad Fauzi Rohman, S.Hum., M.Hum. and Mrs. Lilik Ghoniyah Sofyan, S.Pd., M.Ed. 32
4.2. Disability Friendly Home Design for Mr. Tutus Setiawan, S.Pd., M.Pd. and Mrs. Desy, S.Pd. 43
4.3. Elderly Friendly Home Design for family of Ms. Paulina Mayasari, S.Sn. 56
4.4. Elderly Friendly Home Design for Mr. Hariyono Karno 67
4.5. Fifty-square-meter-and-Wheelchair-Disability-Friendly House for Mr. Abdul Syakur, S.E. 79
4.6. Thirty-Six-square-meter, Wheelchair-and-Blind-friendly Apartment Design 87
4.7. Inclusive School Design for People with Visual Disabilities and People with Disabilities using Wheelchairs 92
Chapter 5. Anti-Covid-19 Inclusive Design Concept 118
5.1. Anti-Covid-19 House Design Concept 118
Chapter 6 128
6.1. Conclusion of the Process 128
6.2. Reflection of the Process 129
Bibliography 132
Description of Writers 134

List of Figures

Figure 1 Accessibility evaluation in people with disabilities' homes. 22
Figure 2 Petra Christian University Students' simulation as people with disabilities. 22
Figure 3 Students' design process. 23
Figure 4 Professional architecture model making. 23
Figure 5 Professional architecture model. 24
Figure 6 Professional architecture model. 24
Figure 7 Discussion process in the Participatory Design Workshop in Surabaya. 25
Figure 8 Discussion process in the Participatory Design Workshop in Surabaya. 25
Figure 9 Discussion process in the Participatory Design Workshop in Bandung. 26
Figure 10 Discussion process in the Participatory Design Workshop in Bandung. 26
Figure 11 The Creative campaign for rights of people with disabilities. 27
Figure 12 The Creative campaign for rights of people with disabilities. 27
Figure 13 The Creative campaign for rights of people with disabilities. 28
Figure 14 The Creative campaign for rights of people with disabilities. 28
Figure 15 The Creative campaign of accessible home for people with disabilities. 29
Figure 16 The Creative campaign of accessible home for people with disabilities. 29
Figure 17 Photo of Ahmad Fauzi Rohman, S.Hum., M.Hum. and his mother Mrs. Lilik Ghoniyah Sofyan, M. Ed. 34
Figure 18 General axonometric (Explanation: 1. Living room, 2. Workplace, 3. Bedroom, 4. Bathroom, 5. Dressing room, 6. Pantry). 35
Figure 19 Plan (Explanation: 1. Living room, 2. Workplace, 3. Bedroom, 4. Bathroom, 5. Dressing room, 6. Pantry). 36
Figure 20 Section. 37
Figure 21 Side Elevation. 37
Figure 22 Front Elevation. 38
Figure 23 Living room perspective. 38
Figure 24 Working space perspective. 39
Figure 25 Working space perspective. 39
Figure 26 Working space perspective. 40
Figure 27 Bedroom perspective. 40
Figure 28 Bathroom perspective. 41
Figure 29 Changing space perspective. 41
Figure 30 Pantry perspective. 42
Figure 31 Sliding door detail. 42

Figure 32 Photo of Tutus Setiawan S.Pd., M.Pd., and Desy, S.Pd. 45
Figure 33 General Axonometric (Explanation: 1. Patio, 2. Living room, 3. Corridor, 4. Bedroom for elderly, 5. Dining room, 6. Kitchen, 7. Stairs, 8. Bathroom, 9. Laundry space, 10. Bedroom for visually impaired person, 11 Laundry room, 12. Hobby room, 13. Balcony). 46
Figure 34 First and Second Floor Plan (Explanation: 1. Patio, 2. Living room, 3. Corridor, 4. Bedroom for elderly, 5. Dining room, 6. Kitchen, 7. Stairs, 8. Bathroom, 9. Laundry space, 10. Bedroom for visually impaired person, 11 Laundry room, 12. Hobby room, 13. Balcony). 47
Figure 35 Section. 48
Figure 36 Front Elevation. 49
Figure 37 Perspective of living room. 50
Figure 38 Perspective of main corridor. 50
Figure 39 Perspective of main corridor. 51
Figure 40 Perspective of bedroom of elderly people. 51
Figure 41 Perspective of dining room. 52
Figure 42 Perspective of kitchen. 52
Figure 43 Perspective of laundry room. 53
Figure 44 Perspective of bedroom of people with visual disability. 53
Figure 45 Perspective 2nd floor corridor. 54
Figure 46 Detail of guiding path in the front terrace. 54
Figure 47 Detail of guiding path and ramp in corridor. 55
Figure 48 Photo of Mrs. Paulina Mayasari. 58
Figure 49 Condition of Ms Paulina's House from Googlemaps. 59
Figure 50 Condition of Ms Paulina's House from Googlemaps. 59
Figure 51 Condition of Ms Paulina's House from Googlemaps. 60
Figure 52 General axonometric Explanation: 1. Corridor, 2. Bedroom for elderly, 3. Bedroom, 4. Dining room, 5. Kitchen, 6. Bathroom, 7. Living room). 61
Figure 53 Second Floor Plan (Explanation: 1. Corridor, 2. Bedroom for elderly, 3. Bedroom, 4. Dining room, 5. Kitchen, 6. Bathroom, 7. Living room). 62
Figure 54 Section. 63
Figure 55 Perspective of bedroom for older people. 63
Figure 56 Perspective of bedroom for older people, with portable toilet. 64
Figure 57 Perspective of kitchen and dining area. 64
Figure 58 Perspective of renovated bathroom. 65
Figure 59 Detail of additional safety railing and canopy. 65
Figure 60 Detail of the sliding door. 66
Figure 61 Detail of the anti-slip flooring. 66

Figure 62 Photo of Mr. Hariyono Karno. 69
Figure 63 General axonometric (Explanation: 1. Patio, 2. Workspace, 3. Bedroom for elderly, 4. Kitchen, 5. Bathroom, 6. Stairs, 7. Bedroom for young, 8. Sitting room, 9. Bathroom). 70
Figure 64 First and Second Floor Plan (Explanation: 1. Patio, 2. Workspace, 3. Bedroom for elderly, 4. Kitchen, 5. Bathroom, 6. Stairs, 7. Bedroom for youths, 8. Sitting room, 9. Bathroom). 71
Figure 65 Section. 72
Figure 66 Front Elevation. 73
Figure 67 Rear Elevation. 74
Figure 68 Perspective of shovel workshop area. 75
Figure 69 Perspective of shovel workshop area. 75
Figure 70 Perspective of bedroom of older people. 76
Figure 71 Perspective of kitchen area. 76
Figure 72 Perspective of stairs. 77
Figure 73 Perspective of bedroom of youths in second floor. 77
Figure 74 Detail of folding door. 78
Figure 75 Photo of Mr. Abdul Syakur, S.E. 81
Figure 76 Floor Plan (Explanation: 1. Parking area, 2. Living room, 3.Dining Area and Kitchen, 4. Master Bedroom, 5. Children Bedroom, 6.Bathroom, 7. Front and Back Garden). 82
Figure 77 Perspective of house from the front. 83
Figure 78 Perspective of front terrace with 1:12-ramp and anti-slip flooring. 83
Figure 79 Perspective of the living room, dining area, with the 1.2-meter clear width passageway and sliding door. 84
Figure 80 Perspective of living room, dining area and kitchen. 84
Figure 81 Perspective of kitchen area with wheelchair accessible tops, and anti-slip flooring. 85
Figure 82 Perspective of bathroom with railing, anti-slip flooring, as well as bathing chair. 85
Figure 83 Perspective of visitable children bedroom. 86
Figure 84 Perspective of fully accessed master bedroom. 86
Figure 85 Floor Plan (Explanation: 1. Bed area, 2. Working area, 3. Kitchen, 4, Bathroom). 89
Figure 86 Perspective of working area and pantry that are accessible for wheelchair. 90
Figure 87 Perspective of bed area and storage. 90
Figure 88 Perspective of bedroom, equipped with anti-slip flooring, bathing chair, sitting toilet, railing. and adjustable shower cap. 91
Figure 89 Detail of sliding door. 91
Figure 90 Proposed sliding windows and sliding door. 94

Figure 91 Construction of aluminium sliding door. 94
Figure 92 Construction of aluminium window protector to create safer corridors. 95
Figure 93 Proposed ramp and railings. 95
Figure 94 Construction of ramp and simple-rock-material-guiding path. 96
Figure 95 Proposed additional canopy. 96
Figure 96 Construction of adaptive toilet, with sitting toilet, anti-slip flooring and railing. 97
Figure 97 Ideal-accessible school floor plan (Explanation: 1. Teaching area, 2. Wheelchair-accessible seat, 3. Visually impaired seat, 4. Storage lockers, 5. Speaking computer, 6. Corridor, 7. Stairs, 8. Ramp, 9. Storeroom, 10. Greenery). 99
Figure 98 Perspective of building mass of Ideally-designed-accessible school. 100
Figure 99 Perspective of building mass of Ideally-designed-accessible school. 100
Figure 100 Perspective of building mass of Ideally-designed-accessible school. 101
Figure 101 Front elevation of Ideally-designed-accessible school. 101
Figure 102 Side elevation of Ideally-designed-accessible school. 102
Figure 103 Back elevation of Ideally-designed-accessible school. 102
Figure 104 Section of Ideally-designed-accessible school. 103
Figure 105 Perspective of interior of classroom of the ideal school. 103
Figure 106 Perspective of interior of classroom of the ideal school. 104
Figure 107 Detail of sliding door of the ideal school. 104
Figure 108 Perspective accessible stairs of the ideal school. 105
Figure 109 Detail of accessible stairs of the ideal school. 105
Figure 110 Detail of accessible stairs of the ideal school. 106
Figure 111 Perspective of accessible ramp of the ideal school. 106
Figure 112 Detail of guiding path in the ideal school ramps. 107
Figure 113 Detail of guiding path in the ideal school ramps. 107
Figure 114 Detail of accessible ramp of the ideal school. 108
Figure 115 Detail of guiding path in the ideal school ramps. 108
Figure 116 Detail of guiding path in the ideal school ramps. 109
Figure 117 Perspective of interior of toilets of the ideal school. 109
Figure 118 Perspective of interior of toilets of the ideal school. 110
Figure 119 Perspective of corridor of the ideal school. 110
Figure 120 Perspective of corridor of the ideal school. 111
Figure 121 Perspective of corridor of the ideal school. 111

Figure 122 Detail of storage area and railing in corridor of the ideal school. 112
Figure 123 Detail of guiding path in the ideal school corridor. 112
Figure 124 Detail of guiding path in the ideal school corridor. 113
Figure 125 Detail of classroom signage the ideal school. 113
Figure 126 Detail of toilet signage the ideal school. 114
Figure 127 Detail of roof vent on the ideal school. 114
Figure 128 Detail of roof vent on the ideal school. 115
Figure 129 Detail of sliding windows for ventilation on the ideal school. 115
Figure 130 Detail of gutter and water tanks on the ideal school. 116
Figure 131 Detail of water tanks on the ideal school. 117
Figure 132 Zoning Concept. 120
Figure 133 Circulation Concept according to Zoning Concept. 121
Figure 134 Floor Plan (Explanation: 1. Parking area, 2. Guest room, 3. Cleaning area with bathroom, 4. Dining and Living room, 5. Kitchen, 6. Laundry, 7. First Bedroom (for older woman) with attached bathroom, 8. Second Bedroom (for an adult couple) with attached bathroom, 9. Prayer room with attached wudhu room, 10. Central garden, 11. Second garden). 122
Figure 135 General Axonometric (Explanation: 1. Parking area, 2. Guest room, 3. Cleaning area with bathroom, 4. Dining and Living room, 5. Kitchen, 6. Laundry, 7. First Bedroom (for older woman) with attached bathroom, 8. Second Bedroom (for an adult couple) with attached bathroom, 9. Prayer room with attached wudhu room, 10. Central garden, 11. Second garden). 123
Figure 136 Front Elevation. 124
Figure 137 Perspective of house from the front. 124
Figure 138 Perspective of New Normal Guest room. 125
Figure 139 Perspective of Cleaning area with bathroom. 125
Figure 140 Perspective of Cleaning area bathroom. 126
Figure 141 Perspective of Dining and Living room. 126
Figure 142 Perspective of Dining and Living room. 127
Figure 143 Perspective of Second garden. 127

List of Tables

Table 1 Proposed Concept on Human Spectrum. 31
Table 2 Summary comparison of Inclusive Design and Universal Design from Wong (2014). 131

Introduction by Dean of Engineering and Planning Faculty, Petra Christian University

First, we want to thank Lord Jesus for allowing us to publish this great book. This book reflects an inclusive design process supported by UBCHEA (The United Board for Christian Higher Education Asia) and collaboration with many external parties. We also would like to thank UN-Habitat and JICA (Japan International Cooperation Agency) that have supported the Faculty of Engineering and Planning, Petra Christian University in several projects such as:

- UN-Habitat Prepcom 3 Parallel event with the title of Seminar and Field Visit: Inclusive Building and Urban Parks in Surabaya (in collaboration with UN-Habitat, Ministry of Public Works and the Public Housing Republic of Indonesia, Surabaya Municipality and Petra Christian University, July 2016).
- Service Learning of Inclusive Design for Homes and Schools in Surabaya and Bandung, Participatory Design and Campaign (with UBCHEA, Aug 2015 – July 2016).
- Data collection survey on disability and development in Indonesia (with the Japan International Cooperation Agency/ JICA, June 2015 – Sept 2015).

Thank you so much for all parties that we cannot mention one by one in this project.

I hope that Mr Gunawan and the team will continue serving people with disabilities and older peoples' communities to provide more accessible designs. Keep up the great work! When we do have the ability and the opportunity to help someone, it is important that we do so. We cannot solve all the world's problems, but we can be a positive force in the lives we encounter. "Do not withhold good from those to whom it is due, when it is in your power to act." Proverbs 3:27
Soli Deo gloria

Dr. Rudy Setiawan, S.T., M.T.
Dean of the Faculty of Civil Engineering and Planning PCU

Introduction by Head of Architecture Study Program, Petra Christian University

First, I want to thank Lord Jesus for allowing us to publish this excellent book. This book reflects an inclusive design process derived from the Vision and Mission of Architecture Study Program. Our program's vision is to produce graduates committed to Christian Values, recognized for their academic excellence nationally and internationally, and equipped with a mindset of sustainable development and concerned about values of local culture. Besides that, our missions are educating architecture graduates with integrity and creativity to develop a built environment, with sensitivity and empathy towards human needs, environmental insight, and adapt to suit the changing of time.

We translate these missions into Service-Learning Programs that were developed, including the Inclusive Design course under Dr. Joyce M.L., Mr. Gunawan T., Ms. Luciana K. and Prof. Christina E.U. The Inclusive Design course has introduced the empathy towards the people with disabilities and older people to ensure that final accessible designs, such as houses and schools. I hope that Mr Gunawan and the team will continue serving people with disabilities and older people communities. Thank you so much for all parties that we cannot mention one by one in this project.

Prof. Ir. Lilianny Sigit Arifin, M.Sc., Ph.D.
Head of the Architecture Study Program PCU
(Unfinished)

Chapter 1. Introduction

Accessible and proper House and School are essential for the citizens (including people with disabilities, senior residents, pregnant mothers, etc.) World Health Organisation & World Bank (2011) in World Report on Disability stated that more than one billion people live with some form of disabilities, and about 200 million people experience considerable difficulties in functioning. In the years ahead, it is predicted that these numbers are on the rise. The rising older population is due to an ageing population and the global increase in chronic health conditions. On the other hands, people with disability face several problems, such as poorer health outcomes, lower educational achievements, less economic participation, and poverty. These problems are mainly caused by their limited access to information and services, including health, education, employment, and transportation. Nations Convention on Rights of Persons with Disabilities held in May 2008 recommended strategies to empower people with disability and remove the barriers which prevent them getting a quality education, finding decent work, and having their voices heard.

Based on the Republic of Indonesia Law Number 8 of 2016 (Undang-Undang RI No 8 Tahun 2016) concerning People with Disabilities, people with Disabilities must be considered in all aspects of life, especially in living and education. People with disabilities are defined as every people facing intellectual, physical, sensory, and/or mental, limitations for an extended time. They can meet more difficulties and barriers in the environment. They need fulfilment of needs such as life, education, health, living independently, being involved in society, and others. However, many implementations on the ground are found far from the mandate. Latest access regulation of the Minister of Public Works and Public Housing Regulation No. 14/PRT/M/2017 concerning the Requirements for Ease of Building is not fully understood by architects and designers. Therefore, we write this book to increase the level of understanding among stakeholders.

Based on the National Social and Economic Survey conducted by Indonesia Statistics Agency in 2000, there are 1.46 million people in Indonesia living with a disability (about 0.74% of 197 million populations). This finding supports the urgency to provide proper and accessible housing for all citizens (including people with disabilities).

To contribute to people with disability, Architecture Program Study, Petra Christian University conducted SERVICE-LEARNING course in collaboration with University Network Digital Local Knowledge which concerned the needs of people with disability and senior citizens in Surabaya and Bandung. The course, which was established in 2012 by Ir. Joyce Marcella Laurens, M.Arch., and Gunawan T., S.T., M. Sc, attempts to teach and discuss inclusive design principles design which provides convenient features to satisfy the needs of the intended users. The focus of inclusive design creates a more accessible environment and suitable by a broad range of users. This course also assigned small-scaled projects to implement an inclusive design. We conducted the projects held in 2013-2014 through interviews and participative design. We further continued it in 2019-2020.

Several House and School designs presented were created in collaboration with our respondents:

- Ahmad Fauzi Rohman, S.Hum., M.Hum., and Lilik Ghoniyah, S.Pd., M.Ed.
- Abdul Syakur, S.E.
- Tutus Setiawan, S.Pd., M.Pd. and Desy. S.Pd.
- Paulina Mayasari, S.Sn.
- Hariyono Karno
- YPAB Junior High Special School

The respondents represent a broad spectrum of users. First, Ahmad Fauzi Rohman, S.Hum., M.Hum. is a Cerebral Palsy person. This condition causes motor dysfunction resulting in body paralysis, making him unable to walk. He lives with his mother, Mrs. Lilik Ghoniyah, S.Pd. M.Ed. However, he can perform his daily activities independently in a crawling position.

Mr. Abdul Syakur, S.E. is a person with locomotor disability. He uses a wheelchair or crutch to move from one place to another. In his daily activity as a teacher in YPAC (Yayasan Pembinaan Anak Cacat), he uses a wheelchair to move from one classroom to another. In contrast, in his house, he uses crutches. He needs a design which allows him to reach house appliances while sitting in his wheelchair. He also needs railing to help his locomotion.

Mr. Tutus Setiawan, S.Pd., M.Pd. has visual impairment (total blindness) and works as a teacher at Special Junior High School YPAB (Yayasan Pendidikan Anak Buta). Meanwhile, his wife, Desy (also a teacher in YPAB) is a person with low vision. They live in their two-storey residence. He needs textured railing to guide him, moving around the house securely. Meanwhile, his wife, Desy, needs contrasting colour railing to assist her activities.

Mrs. Paulina Mayasari, S.Sn represents her parents and grandmother. She lives in a shop-house in the Old Town Surabaya. The shop-house design is less accessible because it was built in the past and did not accommodate the recent needs of modern citizens. Her 80-year-old grandmother uses a wheelchair while her 60-year-old parents move and stroll. The three users are vulnerable to accidents. Thus, they need security equipment around the house without changing the design of the house.

Mr. Hariyono Karno is a senior citizen living on Bratang Village. His daily activity is making shovels. He needs a residence which also functions as his workshop. The design should consider his economic condition.

SMPLB - A YPAB is a Special School for students with visual disabilities. This school is located at Jalan Gebang Putih No. 5, in East Surabaya. Unfortunately, this school is less accessible for students themselves because of built in 1970s. Thus, accessibility evaluation and inclusive design are needed to address this problem. Assessment and disability-inclusive design were held at the SERVICE-LEARNING Lecture (KKP) - Inclusive Design Petra Christian University. Due to the challenges of flooding at this school and increasing number of students with multiple disabilities (with visual disabilities and with locomotion disabilities using wheelchair), We propose an ideal design for a more inclusive future school.

Chapter 2. Literary Review

Universal Design or Inclusive Design should be applied to decrease discrimination against people with disability. Universal Design has broad-spectrum concepts that are usable for every person, regardless of their ability, age, and status. On the other hand, Inclusive Design is described as mainstream products and services that are usable for as many as possible without specialised design. Therefore, a holistic approach is needed to create this design.

An Inclusive Design approach is organised based on the following principles (University of Cambridge, 2018).

- User Centred: An observation with a strong focus and a convenient design framework should be arranged to figure out the user needs.
- Population Aware: there should be an awareness that there is a broad spectrum of capabilities in any population.
- Business-Focused: Decisions that are made during a design process can affect user satisfaction and design inclusion.

Meanwhile, A group of people in North Carolina State University proposed seven principles of Universal Design in 1997 as a guide for designers (Connell, et al. 1997):

- FIRST PRINCIPLE: Equitable Use - The Design is accessible to people with diverse abilities.
- SECOND PRINCIPLE: Flexibility in Use - The Design is flexible enough to accommodate every individual preferences and ability.
- THIRD PRINCIPLE: Simple and Intuitive Use – the design should be simple to be understood for every user.
- FOURTH PRINCIPLE: Perceptible Information - Important information can be delivered effectively to the user from the design.
- FIFTH PRINCIPLE: Tolerance for Error - The Design reduces the consequences of accidental actions.
- SIXTH PRINCIPLE: Low Physical Efforts - The Design can be easily used with less fatigue.
- SEVENTH PRINCIPLE: Size and Space for Approach and Use - Appropriate size and space is granted for every user

Inclusive design accommodates effective, economical, and creative answers, not only following the guidelines. The inclusive design also must fulfil these criteria (University of Cambridge, 2018):

- Functional – The product must afford features that can satisfy the demand from the users.
- Usable – The product should be able to operate efficiently.
- Desirable – The product should be desirable in many aspects.
- Viable – The product should be profitable.

With universal design, every product and building should be designed to be usable in maximum. This design is revolutionary and practical in the evolution of a building. Below are the main features of Universal Design proposed by Maisel, Smith & Steinfeld (2008).

ENTRANCE

1. STEPLESS ENTRANCE

It is recommended that all home entrance have little to no step. There should be at least one step less entrance. The step-less design will make work like moving furniture, park baby strollers and bicycles, bring in groceries and packages, clear snow, ice, and leaves way easier. In wet or icy conditions, it will be safer to have a step-less entrance.

2. OTHER ENTRANCE FEATURES

There should be One-half inch maximum rice at the entrance to minimise tripping hazards. There must be space on both sides of the entry door at least 5 inches x 5 inches. There should be a weather shield to create sheltered space for people and reducing damage to door finish. Windows in doors or nearby are also necessary for the residents to identify people outside the door. A light should be provided outside the entry door and controlled by the motion detector generally. Finally, house number should be significant and contrast enough to make people locate it.

3. INTERIOR CIRCULATION

There should be an open design to minimise hallways and doorways and can also maximise sightlines. There is also at least one bedroom and accessible ground floor. A clear door-width of 32 inches must be provided to ensure circulation for all users. Finally, there should be 42 inches minimum width circulation route with 5 feet diameter for turning space in all rooms.

4. VERTICAL CIRCULATION
An appropriate width is needed for all stairs, and there should be a space at the bottom for platform lift installation.

5. BATHROOM
There should be a clear space in front and to one side of the toilet with 3 feet width to ensure easy moving around the toilet. There should also be a broad blocking in walls for future placement and relocation if bars used to grab. The bars itself should use material other than stainless steel or chrome. The long mirror should be located with bottom no more than 36 inches above the floor and minimum 72 inches high. The showerhead should have adjustable height and movable.

6. SWITCHES AND CONTROLS
The light switches should be reachable with hands and elbow and accessible to children. For personal use equipment, there should be an electrical outlet at beds and desks.

7. WINDOWS
Wider windows proposed for bringing natural light to the room.

Creating a more viable building and community for all is Universal Design's objective, according to Maisel, Smith & Steinfeld (2008). There are five main aspects of Universal Design that summarised into one principle called home visitability. The five aspects are marketability, security, social interaction, sustainability, and affordability. This principle is a strategy to improve the accessibility of residence in the US. To summarise it, the application of accessible design is very crucial in home and school design for people with disabilities.

Chapter 3. Inclusive Design Process in the Book

To solve the people with disabilities housing and education needs, the Architecture Program Study created an Inclusive Design Service-Learning Program.

Literature review of the Person with Disabilities is the first step of the course focused on Inclusive Design. We firstly conducted the documentation with database and interview. However, the person with disabilities was sensitive to the issue. Therefore, only a few people with disabilities are willing to be interviewed and volunteered as design resource persons.

The course required the Petra Christian University students to conduct a simulation as people with disabilities in the Petra Campus environment. With evaluating inclusive and universal theories of design, we later prepared several plans. Knowledgeable people with disabilities further reviewed the designs with disabilities and other architecture students in three design workshops in Surabaya and Bandung. Therefore, role play as disabilities; and user-centred inclusive design process were the vital essential activities.

The program later conducted a Creative Campaign for Universal Design utilization in Surabaya. The campaign distributed bulletin about the person with disabilities' rights, handing out the first edition of Living in Dignity Book, and holding an inclusive artistic event with students from YPAB school and Siswa Budhi school in 2016-2017. We conducted this activity with Petra Christian University Library (the Library@Petra) and General Education Department.

We also conducted other campaigns to disseminate accessible and healthy homes in YPAB school, Siswa Budhi school, and other public schools in Surabaya. We completed the efforts in 2016-2018 period. We also published several papers in relation to this book, such as:

- Tanuwidjaja, et al. (2013),
- Tanuwidjaja, et al. (2016),
- Wulandari, et al. (2017, October),
- Tanuwidjaja, et al. (2018, December),
- Tanuwidjaja, Rieger & Franz (2019, July).

Figure 1 Accessibility evaluation in people with disabilities' homes.

Figure 2 Petra Christian University Students' simulation as people with disabilities.

Figure 3 Students' design process.

Figure 4 Professional architecture model making.

Figure 5 Professional architecture model.

Figure 6 Professional architecture model.

Figure 7 Discussion process in the Participatory Design Workshop in Surabaya.

Figure 8 Discussion process in the Participatory Design Workshop in Surabaya.

Figure 9 Discussion process in the Participatory Design Workshop in Bandung.

Figure 10 Discussion process in the Participatory Design Workshop in Bandung.

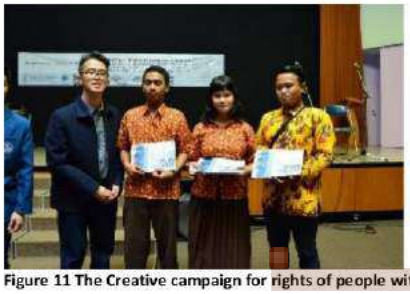

Figure 11 The Creative campaign for rights of people with disabilities.

Figure 12 The Creative campaign for rights of people with disabilities.

Figure 13 The Creative campaign for rights of people with disabilities.

Figure 14 The Creative campaign for rights of people with disabilities.

Figure 15 The Creative campaign of accessible home for people with disabilities.

Figure 16 The Creative campaign of accessible home for people with disabilities.

Chapter 4. A New Concept of Inclusive Design

Realizing that the principles of Inclusive Design and Universal Design are not entirely perfect, a combination of them is proposed. The seven principles of Universal Design and the three principles of Inclusive Design are combined into 5 (five) principles of Inclusive Design as introduced by Tanuwidjaja (2015):

- USER CENTERED Designing process must involve the users and creating more usable products. This aspect covers user centred and population awareness aspects of Inclusive Design.
- EQUITABLE USE BUT REASONABLE Design includes space availability for access of users, while still financially feasible. This aspect covers equitable use, flexibility in use, size and space for approach and use of Universal Design; also business practices of Inclusive Design.
- SIMPLE AND INTUITIVE USE Design shows simple and intuitive application of the design supported by signal or other media such as sounds, voices, and touches. This aspect particularly covers Simple and Intuitive Use as well as Perceptible Information of the Universal Design.
- LOW PHYSICAL EFFORT Design assures convenient use for disabled people. This aspect covers Low Physical Effort of the Universal Design.
- PROHIBITION OF USAGE ERROR Design should be safe and less harmful for users. This aspect covers Tolerance of Error as suggested by the Universal Design because tolerance of error is often seen as an incorrect design.

A fundamental difference of the five principles is the condition of this developing country and financial limitation. Moreover, it is considered to involve users in the design to fulfill their various needs.

Moreover, there are some adjustments on the user spectrum proposed by Inclusive Design and Universal Design. This does not mean that there are differences in the various aspects proposed. For example, a disabled user can be put in several aspects of classification as body size, age, health condition, and particular impaired ability. It concludes that inclusive design is different from each user. However, it must consider specific spectrums of certain populations. For instance, in a house for people with visual impairment, the accessibility of total blind and low vision users should be given more attention than the disabled people on wheelchairs. Therefore, design workshops and observation are compulsory in an inclusive design accomplishment. The design combination is briefly explained in Table 2.

Table 1 Proposed Concept on Human Spectrum.

Spectrums of user based on Inclusive Design Source: University of Cambridge, (2018).	**Spectrums of users based on Universal Design** Source: Connell, et al. (1997):	**Spectrum of users based on Inclusive Design in developing countries as proposed by Tanuwidjaja**
• Sensory: vision and hearing. • Cognitive: thinking and communication. • Motor: locomotion, reach & stretch and dexterity.	• Cognition, • Vision, • Hearing and speech, • Body Functions, • Arm Functions, • Hand Functions, • Mobility, • Variations should be considered are: age, disability, the Environment, particular situations.	• Anthropometry, • Ages, • Health Conditions, • Different ability o Vision o Hearing o Thinking o Communication o Locomotion o Reach o Stretch o Dexterity, • Behavioural and Cultural Backgrounds.

4.1. Cerebral Palsy Friendly Home Design for Mr. Ahmad Fauzi Rohman, S.Hum., M.Hum. and Mrs. Lilik Ghoniyah Sofyan, S.Pd., M.Ed.

Designed by:	Gunawan Tanuwidjaja, S.T., M.Sc., IAI.; Hendy Gunawan, S.T.; Rebecca, S.T.; Dicky, S.T.; Yovita Hadi ,S.T.; Theodorus Akwila P. ,S.T.; Gideon Arief T., S.T.; Yovita Sandra Kusuma ,S.T.

Analysis

It is the residence of Ahmad Fauzi and Lilik Ghoniyah Sofyan. The spectrum disability of Ahmad Fauzi is Cerebral Palsy. He has limitations in his locomotion, reach, stretch, and dexterity especially on his lower and left part of the body. In doing his daily activities, he is helped by his beloved mother, Mrs. Lilik Ghoniyah Sofyan. His disability requires lower-level equipment to make it reachable. This condition requires specific design different from general living house design.

Another additional design required in this Service-Learning Course C is accessibility for wheelchair users. Therefore, it will help Mr. Ahmad Fauzi's mobility in the house. Although Mr. Ahmad Fauzi does not prepare his own meals, it is suggested that he will be able to do that on his own in the future by providing simple convenient pantry.

Concept

In general, the basic idea is a compact house for Ahmad Fauzi next to the main house where Lilik Ghoniyah Sofyan and family live. The house should be accessible independently and convenient for Ahmad Fauzi in doing his daily activities. It has to consider the measurement and height level in order to help Ahmad Fauzi's locomotion. Basically, there are living room, multi-function room (for family and working), bedroom, bathroom, and pantry.

Tanuwidjaja's Five Principles of Inclusive Design is applied in this house, and there are:

USER CENTERED is applied by involving Ahmad Fauzi and Lilik Ghoniyah Sofyan in interviews, observations, and design workshops. Meanwhile, the design focuses on fulfilling Ahmad Fauzi's needs.

EQUITABLE USE BUT REASONABLE principle is applied in the installation of windows, opening and glass doors to give outdoor view for Ahmad Fauzi. The height of all furniture is adjusted to his reach. The bed and working desk are 3 cm above the floor. Therefore, the spring bed which is more than 15 cm is implanted in the floor for more convenient reach.

Moreover, another implication of this principle lies in the arrangement of other furniture such as computer desk; pantry table, bookshelf, and cupboard are 10 cm above the floor. Meanwhile, electronic outlets are also placed at the same height. However, to accommodate other users or Ahmad Fauzi's family in the future, regular electronic outlets and cupboards are installed on regular height. The doors are made wide enough to provide convenient access for wheelchair movement (85 cm width). This will anticipate Ahmad Fauzi's movement with his wheelchairs.

Additionally, the bathroom is completed with two kinds of shower installation for Ahmad Fauzi and other users in convenience. The first one is installed at 20 cm above the floor and the other one is at normal height (about 80 cm above the floor and the showerhead is 170 cm). Two different toilets (squat toilet and sitting toilet) are also provided for Ahmad Fauzi and other users' convenience.

SIMPLE AND INTUITIVE USE is applied by making a sliding door and plastic curtain to separate each room. Also, switches and controls design is equipped with instruction labels. Moreover, the sprinkler in the bathroom is installed 10 cm high above the floor so it is reachable.

LOW PHYSICAL EFFORT is completed by arranging the rooms close to one another and avoiding floor level differentiation.

PROHIBITION OF USAGE ERROR is applied on the use of vinyl flooring to help Mr. Ahmad Fauzi moves safely. Cleaning Vinyl flooring is also easier. Electric sockets are covered with plastic to ensure children safety and direct contact with water from the outside.

Figure 17 Photo of Ahmad Fauzi Rohman, S.Hum., M.Hum. and his mother Mrs. Lilik Ghoniyah Sofyan, M. Ed.

Figure 18 General axonometric (Explanation: 1. Living room, 2. Workplace, 3. Bedroom, 4. Bathroom, 5. Dressing room, 6. Pantry).

Figure 19 Plan (Explanation: 1. Living room, 2. Workplace, 3. Bedroom, 4. Bathroom, 5. Dressing room, 6. Pantry).

Figure 20 Section.

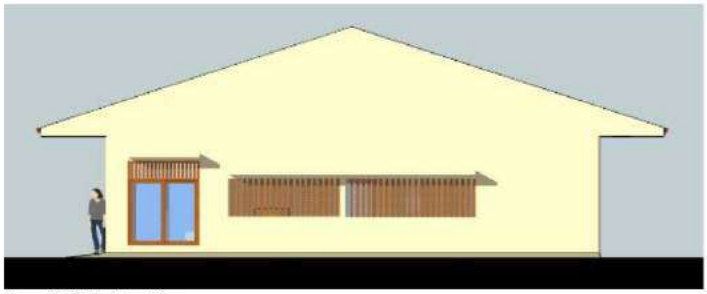

Figure 21 Side Elevation.

Figure 22 Front Elevation.

Figure 23 Living room perspective.

Figure 24 Working space perspective.

Figure 25 Working space perspective.

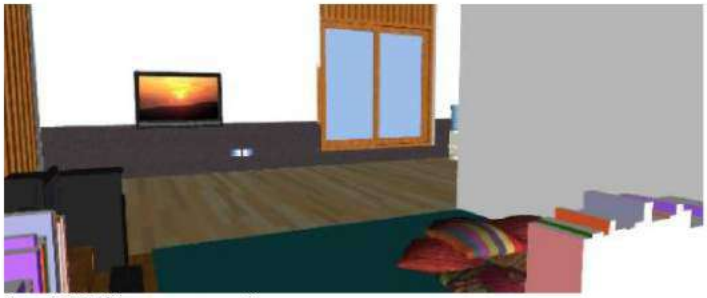

Figure 26 Working space perspective.

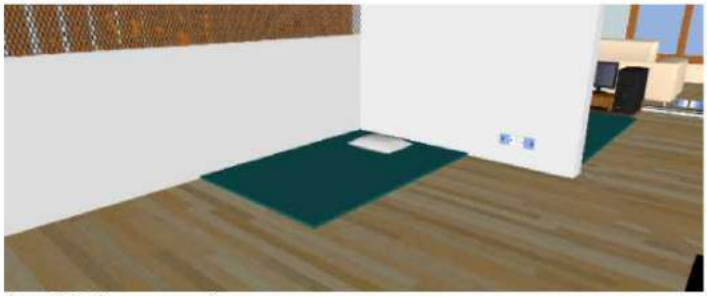

Figure 27 Bedroom perspective.

Figure 28 Bathroom perspective.

Figure 29 Changing space perspective.

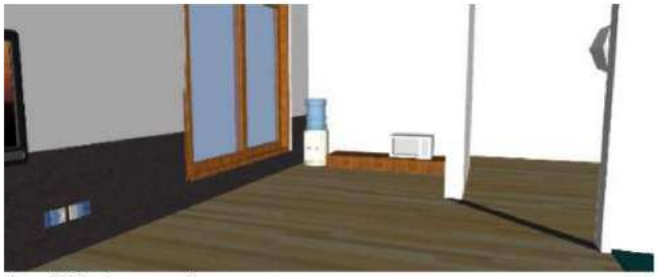

Figure 30 Pantry perspective.

Figure 31 Sliding door detail.

4.2. Disability Friendly Home Design for Mr. Tutus Setiawan, S.Pd., M.Pd. and Mrs. Desy, S.Pd.

Designed by:	Gunawan Tanuwidjaja, S.T., M.Sc., IAI.; Cindy Fransisca, S.T.; Anneke Debora, S.T.; Wenny, S.T.; Nerissa Kumala Tandiono, S.T.; Melissa Stefani, S.T.; Catharina Anggraeni G., S.T.; Barca Hadi J., S.T.; Samuel Anggono, S.T.; Patricia Ellen Setiawan, S.T.

Analysis

This house is the residence of Mr. Tutus Setiawan and Mrs. Desy along with Mr. Tutus' parents. Spectrum disability of Mr. Tutus Setiawan is severe vision impairment or total blind. His wife, Mrs. Desy is having low vision impairment. Total blindness requires tactile markers and fixed furniture location. Meanwhile, low vision requires contrast colors to distinguish the tip of the stairs or wall that may disturb their mobility in the house. Low visions also avoid strong light as they are still able to accept low/limited light (dim). Therefore, it is recommended to use matte material. The house is a two-storey building, which shows that there is no problem for visual impairment people to use the stairs. However, it needs more details in the design considering the height and other safety requirement.

Concept

Additional requirement in this Service-Learning Course C is to provide a design where the two main residents can independently do their activities in the house. The general concept is building a linear layout in a two-storey house to provide convenient and independent living residents. Additionally, the layout is also prepared to comfort other people with low vision who visit the house for the first time. The house is built with different wall textures and floor on each room, color strips to the tread at the nosing of each step and wall to make it obvious. In addition, railing-set provides safety for the residents.

This house is designed using the five Principles of Inclusive Design according to Tanuwidjaja:

USER CENTERED is completed by involving Mr. Tutus Setiawan and Mrs. Desy in interviews, observations, and workshops of the design.

EQUITABLE USE BUT REASONABLE is applied by building a simple guiding path and colour differentiation at the end of wall and furniture. It is to provide convenience for the two residents. Moreover, different width of flooring is reduced or accommodated by applying ramp 1:12 that will also help the resident's mobility. This house does not provide facilities for every disability, especially wheelchair access to the second floor due to its affordability.

SIMPLE AND INTUITIVE USE is applied by arranging the room layout as efficient as accessible to the users. Additionally, the setting is also helped by creating straight corridors, guiding path settings, arranging furniture to establish clear pathways, different wall textures and railing settings.

LOW PHYSICAL EFFORT principle is fulfilled by reducing elevation. Borders are also installed on the stairs to provide rest areas.

PROHIBITION OF USAGE ERROR is provided by applying contrast colours on the edges of walls and furniture to assist low vision users locating their surroundings. The edges are also made rounded for safety. The tread nosing of the stairs is covered with threads or rubber to prevent slippery and to give clear signs about the stairs.

Figure 32 Photo of Tutus Setiawan S.Pd., M.Pd., and Desy, S.Pd.

Figure 33 General Axonometric (Explanation: 1. Patio, 2. Living room, 3. Corridor, 4. Bedroom for elderly, 5. Dining room, 6. Kitchen, 7. Stairs, 8. Bathroom, 9. Laundry space, 10. Bedroom for visually impaired person, 11 Laundry room, 12. Hobby room, 13. Balcony).

Figure 34 First and Second Floor Plan (Explanation: 1. Patio, 2. Living room, 3. Corridor, 4. Bedroom for elderly, 5. Dining room, 6. Kitchen, 7. Stairs, 8. Bathroom, 9. Laundry space, 10. Bedroom for visually impaired person, 11 Laundry room, 12. Hobby room, 13. Balcony).

Figure 35 Section.

Figure 36 Front Elevation.

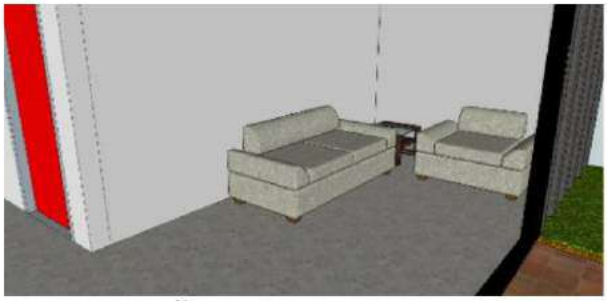

Figure 37 Perspective of living room.

Figure 38 Perspective of main corridor.

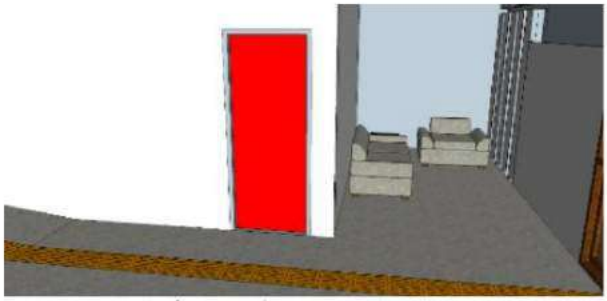

Figure 39 Perspective of main corridor.

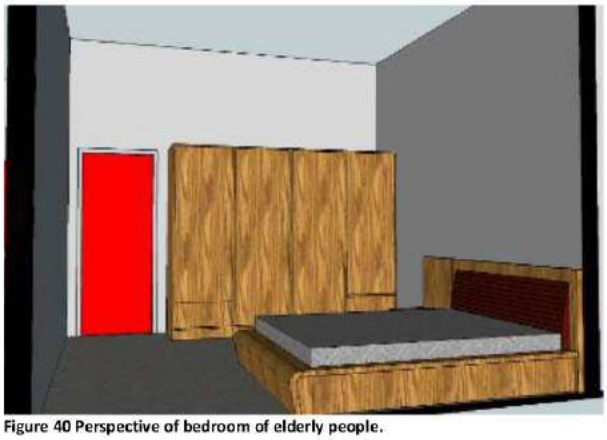

Figure 40 Perspective of bedroom of elderly people.

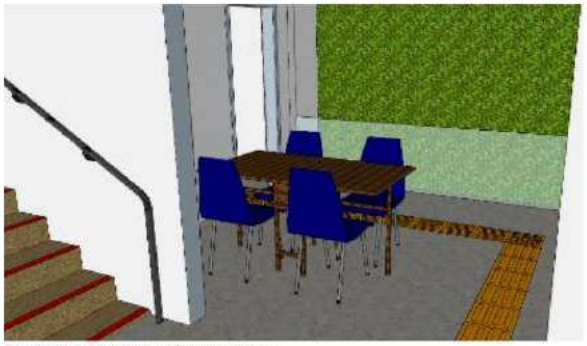

Figure 41 Perspective of dining room.

Figure 42 Perspective of kitchen.

Figure 43 Perspective of laundry room.

Figure 44 Perspective of bedroom of people with visual disability.

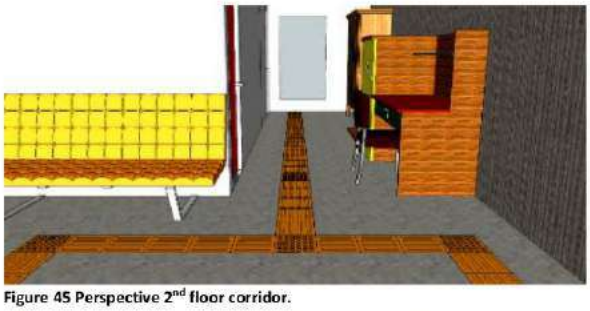

Figure 45 Perspective 2nd floor corridor.

Figure 46 Detail of guiding path in the front terrace.

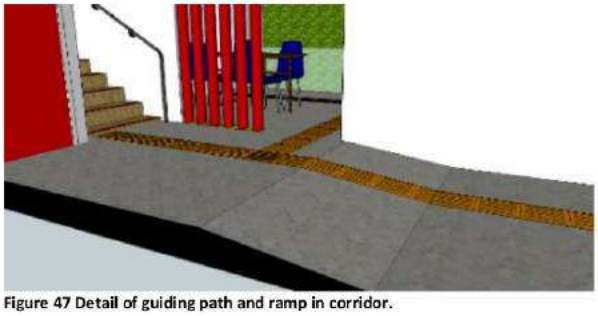

Figure 47 Detail of guiding path and ramp in corridor.

4.3. Elderly Friendly Home Design for family of Ms. Paulina Mayasari, S.Sn.

Designed by:	Gunawan Tanuwidjaja, S.T., M.Sc., IAI.; Aaron Sutanto P., S.T.; Fenny Gunawan, S.T.; Marina Victoria D., S.T.; Ronny Chandra K., S.T.; Roby Ismanto, S.T,

Analysis

Mrs. Paulina Mayasari and her family are the owners of this house. It is a shophouse located in Surabaya Old City. Mrs. Paulina does not live in this house, but her grandmother and parents do. However, she is involved actively during interviews and workshops supporting the team to do the work. Mrs. Paulina's grandmother and parents are elderly with some limitation in movement and dexterity. Since the house was built years ago, the house does not fulfill the current needs and requirements of the users.

The spectrum disability of Mrs. Paulina's grandmother, mother, and father is their ages. Her grandmother is aged 80 and uses a wheelchair; therefore, her locomotion, reach, and dexterity are limited. Mrs. Paulina's father and mother are both aged 60 with good locomotion but limited in dexterity. They are vulnerable to accidents that may occur when being active in the house. They need a design to put additional safety to the house without renovating the entire construction of the house.

Additional requirement in this Service-Learning Course C is to maintain the old design of the house. The house is built in colonial design and located in the old city of Surabaya. All buildings in the conservatory area are prohibited to be changed or renovated. Moreover, the limited time of working on the project and the permission to process the first floor to the authority make the design applicable only on the second floor. Since the lower floor of the house is rented, therefore the design should not bother the residents. Permission from the government of Cultural Heritage Board of Surabaya City is necessary prior to the installation of elevators to access users on the lower floor to go upstairs.

Concept

In general, the design concept is to retain the original design of the house since it is one of historical heritage in Surabaya Chinatown. To provide helpful facilities for the users, some access will be renovated, such as bedrooms, bathrooms, living room, kitchen, and dining room without changing the basic structure of the building.

The design applies the five Principles of Inclusive Design according to Tanuwidjaja as follow:

USER CENTERED. As in other house designing processes, Mrs. Paulina Mayasari and her family are involved in interviews and workshops. This approach can be applied in designing conserved-old houses.

EQUITABLE USE BUT REASONABLE is still applied, even though this is an old building that cannot be changed entirely to be more accessible. Therefore, consideration of equal adjustment can only be applied partially. Several rooms are not accessible by grandmother who uses a wheelchair because of limited room and expensive elevator installation. However, all rooms are accessible for Mrs. Paulina Mayasari's parents; bedpans are available to help their dexterity limitation when they have to go to the toilet at night. It is an equivalent. Moreover, the heights of stairs which connect rooms are adjusted from about 25 cm to 10 cm. Those stairs are also equipped with different colors of nosing.

SIMPLE AND INTUITIVE USE is implemented in several designs such as door handle and sitting toilet. This concept cannot be implemented entirely because of the building's condition.

LOW PHYSICAL EFFORT is applied by adding mobility aid between rooms like railing. Sliding door with light material is also recommended to help the residents open the door easily.

PROHIBITION OF USAGE ERROR is the main aspect implied in this design regarding changes limitation. Design for this house should be safe for the elderly users. Therefore, it is recommended to cover roof and ventilation with glass/clear material. In the past, rainwater poured in the house through the ventilation and made the place slippery. Since it will be covered with glass material, additional ventilation will be made on the other side of the building to keep the air quality. Moreover, the floor will be covered with anti-slip tiles.

Figure 48 Photo of Mrs. Paulina Mayasari.

Figure 49 Condition of Ms Paulina's House from Googlemaps.

Figure 50 Condition of Ms Paulina's House from Googlemaps.

Figure 51 Condition of Ms Paulina's House from Googlemaps.

Figure 52 General axonometric Explanation: 1. Corridor, 2. Bedroom for elderly, 3. Bedroom, 4. Dining room, 5. Kitchen, 6. Bathroom, 7. Living room).

Figure 53 Second Floor Plan (Explanation: 1. Corridor, 2. Bedroom for elderly, 3. Bedroom, 4. Dining room, 5. Kitchen, 6. Bathroom, 7. Living room).

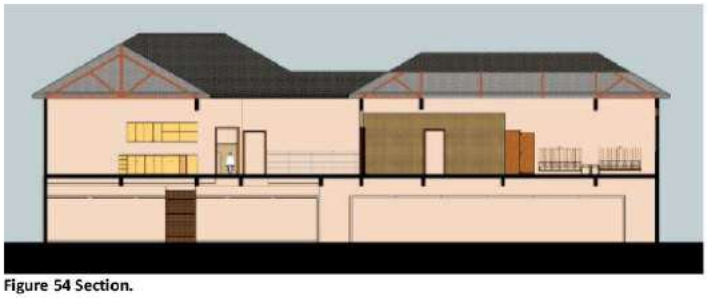

Figure 54 Section.

Figure 55 Perspective of bedroom for older people.

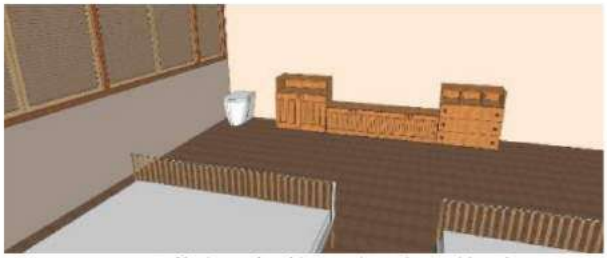

Figure 56 Perspective of bedroom for older people, with portable toilet.

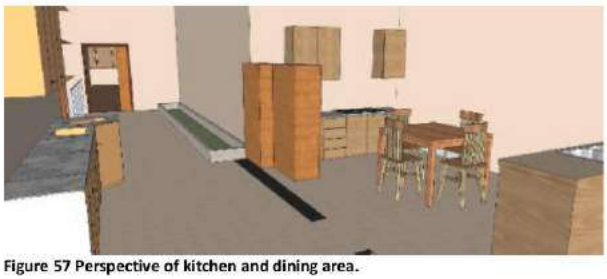

Figure 57 Perspective of kitchen and dining area.

Figure 58 Perspective of renovated bathroom.

Figure 59 Detail of additional safety railing and canopy.

Figure 60 Detail of the sliding door.

Figure 61 Detail of the anti-slip flooring.

4.4. Elderly Friendly Home Design for Mr. Hariyono Karno

Designed by:	Gunawan Tanuwidjaja, S.T., M.Sc., IAI.; Cendana Marcheliwan P., S.T.; Anneke Clauvinia P., S.T.; Veronica Yuwono, S.T.; Michelle Mimosa,S.T.; Puspita Rani,S.T.; Gatot Subroto.

Analysis

The house is the residence of Mr. and Mrs. Hariyono Karno with their children in Kampung Bratang.
The spectrum disability of Mr. and Mrs. Hariyono is senior citizens at the age of 60s, and their children aged 20 and 30 years old. Mr. and Mrs. Hariyono Karno are in good health, therefore the limitation only lies on dexterity. Their children do not have any limitation.

Moreover, an additional requirement in this Service-Learning Course C is that the house can be used as a working space. The working activity has been productive for some time. Mr. Hariyono Karno produces shovels for gardening and making compost. For several years, the activity has been running several stages of the production in different houses in the village. Due to this reason, it is suggested to build a two-storey house. The first floor will be used for business, bedroom, and bathroom for the seniors. Meanwhile, the second floor will be used for bedrooms, bathrooms, and multi-function space for Mr. Hariyono's two children.

Concept

The concept of this house is generally called as Green Business House on the river side (Jagir River) that gives access for both the seniors and the youngsters. The design of this working house is considerably fulfilling the needs of river side residents who have less proper living previously. Therefore, the design includes affordable local materials (exposed bricks and bamboo). The design brings Jogo Kali and Uniformity in Diversity concepts to be applied as stated by PWSS. It is the cooperation of PWSS and Petra Christian University Service-Learning.

This house is built using the five Principals of Inclusive Design of Tanuwidjaja as follows:

USER CENTERED is applied by conducting Mr. Hariyono Karno and family in some interviews and workshops within two months periods.

EQUITABLE USE BUT REASONABLE is applied in the house. Regarding the affordability of this house, it does not provide facilities for all kinds of disability especially wheelchair users on the second floor. However, the working space and several rooms for the seniors are located on the first floor.

EQUITABLE USE BUT REASONABLE is also implied by designing the working space lower than the actual floor. It is considering the habit of the residents working on printing while sitting on their crossed legs or low bench. It also makes the workspace wider and more flexible.

SIMPLE AND INTUITIVE USE applied in this house. The position of the rooms that are closer to each other and more accessible are the result of applying this concept. Moreover, a door design that can be fully opened is also suggested to provide proper ventilation and working movement in the shovel factory.

Additionally, SIMPLE, AND INTUITIVE USE is also applied in bathroom design by using squat toilets to cover the needs of village people. The difference is the availability of railing to ensure the user safety.

LOW PHYSICAL EFFORT is applied by locating rooms for working and for the seniors to do their activities on the first floor. Moreover, the stairs are located outside the building for safe access to Mr. Hariyono Karno's children to access the 2nd floor. The stairs are also equipped with railing to secure the users.

PROHIBITION OF USAGE ERROR is applied in the use of anti-slip plaster floor. Besides, other safeguards are also made by providing railing in the bathroom and stairs. The material for the floor and stairs is chosen considering their affordable prices and ease of process by local craftsmen. Meanwhile exposed bricks material is applied on the outside building for a holistic concept of PWSS.

Moreover, the owner suggested considering psychological factors in providing ideal requirements. Therefore, the owner suggests less accessible design since he does not expect changes in his first floor, while suggesting the second floor as working space.

Figure 62 Photo of Mr. Hariyono Karno.

Figure 63 General axonometric (Explanation: 1. Patio, 2. Workspace, 3. Bedroom for elderly, 4. Kitchen, 5. Bathroom, 6. Stairs, 7. Bedroom for young, 8. Sitting room, 9. Bathroom).

Figure 64 First and Second Floor Plan (Explanation: 1. Patio, 2. Workspace, 3. Bedroom for elderly, 4. Kitchen, 5. Bathroom, 6. Stairs, 7. Bedroom for youths, 8. Sitting room, 9. Bathroom).

Figure 65 Section.

Figure 66 Front Elevation.

Figure 67 Rear Elevation.

Figure 68 Perspective of shovel workshop area.

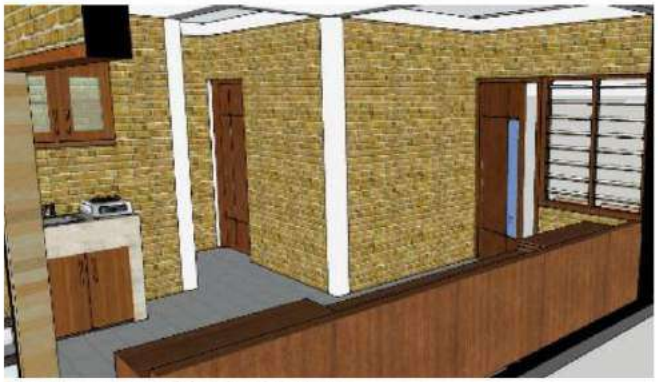

Figure 69 Perspective of shovel workshop area.

Figure 70 Perspective of bedroom of older people.

Figure 71 Perspective of kitchen area.

Figure 72 Perspective of stairs.

Figure 73 Perspective of bedroom of youths in second floor.

Figure 74 Detail of folding door.

4.5. Fifty-square-meter-and-Wheelchair-Disability-Friendly House for Mr. Abdul Syakur, S.E.

Designed by:	Gunawan Tanuwidjaja, S.T., M.Sc., IAI.; Louis Satria Purwanto, S.T.; Ivan Vilano, S.T.; Andre Sugianto, S.T.; Terry Christianto Suroso, S.T.; Tiffany Tommy, S.T.; Maria Monica Rampisela, S.T.; Aswin Pratama W., S.T.; Jocelin Marchelina, S.Ars.; Felicia Lisandra, S.Ars.; Clara Cynthia W., S.Ars.; Yohan Surya Pranata, S.Ars.; Estherina Gazali, S.Ars.

Analysis

This house is designed for Mr. Abdul Syakur (38 years old) with his wife and two children. The spectrum disability of Mr. Abdul Syakur is locomotion activity limitation (legs mobility dysfunction) and only able to use his arms to move his body. This disability requires him to use a wheelchair or a crutch to help his mobility. He mostly uses a wheelchair in his working space, a foundation of development for children with disabilities. While at home, he uses a crutch to do his activities. Furthermore, facilities needed at his house are ramp, accessible furniture, and railing to help his mobility.

An additional task in Service-Learning Course C is to make his house accessible and convenient for Mr. Abdul Syakur's family. Outside the home, parking area for three-wheel-motorcycle is also provided.

In general, the basic concept is designing a medium-size house that can be inhabited conveniently and independently by people with motor disability. Several rooms needed are a living room, bedroom, dining room, laundry room, and tri-motor-cycle parking area. The size of doors, corridors, and rooms are designed considering convenient access for wheelchairs. The design is hopefully can be applied in other houses of wheelchairs users in their daily life.

Concept

To suit his need, we developed a fifty-one square meter house in the south of Surabaya for the case study. This house is located in housing in the suburban area. The suburban of Surabaya has an affordable land price, especially for people with disabilities. The house is small to respond to the needs of the Person with Disabilities, but big enough to accommodate one family consisting of Mr. Abdul Syakur, S.E., his two children, and his wife.

This inclusive house design applies design principles, according to Tanuwidjaja.
Through discussion, workshops, and interview with Mr. Abdul Syakur, we applied the USER CENTERED principle.

EQUITABLE USE BUT REASONABLE principle was applied by designing a little to no level difference and designing doors and pathways accessible to wheelchair users. Instead of stairs, the design use ramps with 1:20 height-length ratio.

To make an uncomplicated and accessible circulation for wheelchair users, we implemented a linear circulation. Therefore, we also fulfill SIMPLE, AND INTUITIVE USE principle with the simple layout.

The fourth principles, LOW PHYSICAL EFFORT, was applied by choosing to use light- sliding doors. We adjust some customized furniture to facilitate the limited reaching range. For instance, the windows are 60 cm height to match the eye level of wheelchair users and switches installed on 110 cm height so the wheelchair users can reach it easily.

The furniture was also designed with rounded edges to fulfil the fifth principle, PROHIBITION OF USAGE ERROR. The bathroom is equipped with steady features and railing and safe flooring material such as anti-slip ceramics.

Figure 75 Photo of Mr. Abdul Syakur, S.E.

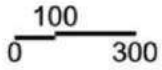

Figure 76 Floor Plan (Explanation: 1. Parking area, 2. Living room, 3.Dining Area and Kitchen, 4. Master Bedroom, 5. Children Bedroom, 6.Bathroom, 7. Front and Back Garden).

Figure 77 Perspective of house from the front.

Figure 78 Perspective of front terrace with 1:12-ramp and anti-slip flooring.

Figure 79 Perspective of the living room, dining area, with the 1.2-meter clear width passageway and sliding door.

Figure 80 Perspective of living room, dining area and kitchen.

Figure 81 Perspective of kitchen area with wheelchair accessible tops, and anti-slip flooring.

Figure 82 Perspective of bathroom with railing, anti-slip flooring, as well as bathing chair.

Figure 83 Perspective of visitable children bedroom.

Figure 84 Perspective of fully accessed master bedroom.

4.6. Thirty-Six-square-meter, Wheelchair-and-Blind-friendly Apartment Design

Designed by:	Gunawan Tanuwidjaja, S.T., M.Sc., IAI.; Joyie, S.Ars.; Albert Limanjaya, S.Ars.; Atika Amalia, S.Ars.; Bella Natasya, S.Ars.; Edita Ayu Anjani, S.Ars.; Fatkhur Rokhim Abdillah, S.Ars.; Gregorius Ryan Candra, S.Ars.; Herson Jaya Chandra, S.Ars. M.Ars.; Mas Ridho Aji Dewa, S.Ars.; Melisa Arista, S.Ars.; Ricky Gelrandy Halim, S.Ars.; Stanley, S.Ars.; Tan Jessica Aryani, S.Ars.; Valerie Layni Yosephine, S.Ars.; Vienna Puspadewi Anritan, S.Ars.; Waskito Gilang Prakoso, S.Ars.

Analysis

To understand future urban professional housing needs, we created another apartment case study with Dr. Arina as a possible future occupant of the apartment. The room was designed catering potential users with visual disabilities—the participatory design workshops with Dr. Arina and BILIC in Bandung. Similar needs of the previous wheelchair user and people with visual disabilities were also analysed such as the need for accessible countertops, tables; simple and intuitive layout; railings and high-level bed.

Concept

The typical studio apartment in Surabaya is becoming the primary reference for the apartment program. Answering the hot and humid climate need, we relocated the toilet to the outer part of the unit. The apartment's program gratifies from basic daily activities such as taking a bath, sleeping, working, and eating. The apartment design is uncomplicated and adjusted within reach of wheelchair users.

With Five Inclusive Design Principle by Tanuwidjaja, this apartment was designed as explained below:

With Participatory designs and workshop involving Person with Disabilities, the first principle, the USER CENTERED Principle, was applied.

The second principle, EQUITABLE USE BUT REASONABLE, is proposed with using harmonica door for the bathroom. The second one is also applied with a sliding door for the main door with a clear width of 95 cm for wheelchair access. Others application are the 150-cm width circulation in the unit and adjusting the furniture height for accommodating wheelchair users. Lastly, the principle EQUITABLE USE BUT REASONABLE is implemented with adjustable shower (between 110 cm to 170 cm reach) and the water tap height design of 80 cm.

SIMPLE AND INTUITIVE USE is applied in the zoning. The bedroom was placed in the inner part of the unit to have a more comfortable circulation. The third principle is implemented by locating the pantry area and working area in co-location.

LOW PHYSICAL EFFORT is applied by adjusting the furniture size, so it is reachable by a wheelchair user. We proposed flat-level apartments to ensure access of the people with disabilities' activities; however, a little level difference for the bathroom is needed for flushing function (0.3 cm). The toileting chair is installed to minimise the physical effort. The anti-slip linoleum floor is proposed in the bedroom areas for cleaning purposes. Lifts for the public are mandatory to facilitate wheelchair users.

The fifth Principle, PROHIBITION OF USAGE ERROR, is applied with anti-slip material ceramics for the kitchen and toilets. Railing in the bathroom and closed electrical sockets are installed for safety purposes.

The people with visual disabilities (total blind and low vision) needs an additional guiding path for non-sharp edges and corridors. Lift with sound identification is required to inform them about the floor information. They also need shovel and water tub for the bath. For more information, braille signs are needed on some surfaces.

Additional discussion in Bandung with BILIC conducted to explore the people with hearing disabilities. The deaf need specific lamps placed on top of the door frame to facilitate the visual cues in an emergency. The lamps will be linked with a doorbell, fire alarm, and other application. We will transform those alarms into a different light colour that will be transmitted into the particular lamp. Besides the above requirement, the person with hearing disabilities needs a rounded table and seating to make easier sign language communication. On the other hand, they need visual signage to make the wayfinding in the apartment's block easier.

Figure 85 Floor Plan (Explanation: 1. Bed area, 2. Working area, 3. Kitchen, 4, Bathroom).

Figure 86 Perspective of working area and pantry that are accessible for wheelchair.

Figure 87 Perspective of bed area and storage.

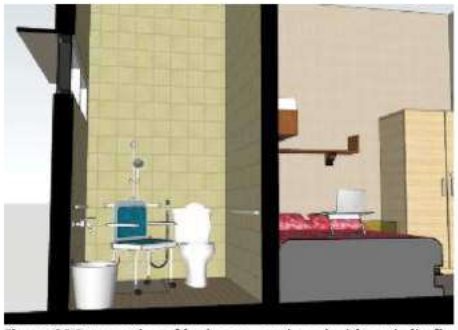

Figure 88 Perspective of bedroom, equipped with anti-slip flooring, bathing chair, sitting toilet, railing. and adjustable shower cap.

Figure 89 Detail of sliding door.

4.7. Inclusive School Design for People with Visual Disabilities and People with Disabilities using Wheelchairs

Designed by:	Petra Christian University Team (Tim UK Petra): Gunawan Tanuwidjaja, S.T., M.Sc., IAI.; Stephany Tandian, S.T.; Feby Adriana Honsujaya, S.T.; Josephine Hardjawikarta, S.T.; Leonard Soeprajitno, S.T.; Felicia Lisandra Soegijono, S.Ars.; El Sadday Agung Oktovianto, S.Ars.; Joyie, S.Ars.; Andreas Nugroho, S.Ars.; Adrian Damaris, S.Ars.; Jimmi, S.Ars.; William Sugianto, S.Ars.;
	Green Impact Indonesia Team (Tim Green Impact Indonesia): Rizky Kurniawan, S.Ars.; Rafli Pradiatama Yusuf, S.Ars.; Fritz Ferlin Kwannandar, S.T.
Campaigned by:	Axel Christian, S.Ars.; Anastasia Mimosa, S.Ars.; Benediktus Ananda Augusta Pranamurti, S.Ars., Calvin Fernadi, S.Ars.; Cindy Natalia, S.Ars.; Daniel Anggoro Susanto, S.Ars.; Edgar Hernandez Tjondro, S.Ars.; Felia Cyndi, S.Ars.; Felicia, S.Ars.; Felix Pratama Suhandinata, S.Ars.; Fulbert Otto Sutanto, S.Ars.; Ignatius Kevin, S.Ars.; Jessica Lupita, S.Ars.; Juan Hogianto, S.Ars.; Nicko Natanael Sukamto, S.Ars.; Raynaldi Septian Tandian, S.Ars.; Reynaldo Ivan Mulya Saputra, S.Ars.; Richmond Pangalila, S.Ars.; Rika Mandasari, S.Ars.; Rudy Hartanto, S.Ars.; Thomas Julian Onggo, S.Ars.; Victor Hartono, S.Ars.; Vincentius Lieyanto, S.Ars.; Yuriko Veni Hansyah Chandra, S.Ars.
School Improvement by:	Petra Christian University Team (Tim UK Petra): Gunawan Tanuwidjaja, S.T., M.Sc.; Ir. I Gusti Nyoman Sulendra; Guszeus Wisnu, S.Ars.; Fanyshia Aditya, S.Ars.; Michaela Bela Hoesny, S.Ars.; Christina, S.Ars.
	SCIA Team (Tim SCIA): Stephen Yona Loanoto, S.T., M.Ars.; Jimmy Effendy Setiawan, S.T.

Analysis

Inclusive schools are needed due to Surabaya's increasing population. Sukolilo District in the eastern area of Surabaya has the most potential since it has a vast land area (23.68 km2) and many residences. Furthermore, the high demand for inclusive education services is evident. The Government of Surabaya and other parties have constructed numerous educational facilities. Meanwhile, in Sukolilo District, there are 25 schools in 2010 and developed into 42 schools in 2011.

The Special Junior High School of Educational Foundation for the Blind Children or SMPLB-A YPAB, is a special school in Jalan Gerbang Putih no 5 Surabaya. Because constructed in the 1970s, the school need accessibility improvement and future school redesigning process. The loss of visual abilities is difficult, but other senses of people with visual disabilities are sometimes improved. The school is designed for people who are incapable of seeing (totally blind) and people with limited visual capability (low vision). People with low vision can still use their visual sense even if it is fainting. They need a contrast colour to guide their activities and movement.

Concept

The evaluation produces two proposed designs; one is the ideal design, and the other is a realistic design. The designs are prepared considering the funding availability and technical difficulties on the ground. Because of the school flooding condition is also considered with raising the level of future classes. The adaption to climate change is also proposed in the ideal design to improve the users' thermal comfort and save rainwater for non-potable usage.

Proposed Realistic Adjustment

The adaptive design is suggested to solve dangerous school features, such as doors design, windows design, and hazardous steps. We produced several simple solutions in the realistic adjustment after implementing participative design and construction from 2013-2017. Several design solutions are abandoned, the sliding windows. The sliding windows were difficult to implement because of low existing wooden windows. On the other hand, several simple solutions are proposed, such as sliding doors, simple ramps, simple guiding paths, and the renovation of the toilet.

A sliding door was designed and constructed with aluminium door and rail. The lighter aluminium material reduced the loads bore by the old wooden door jamb. EQUITABLE USE BUT REASONABLE and LOW PHYSICAL EFFORT principles are implemented with the sliding door design. Simple ramps and simple rocks-based-guiding path are created to increase the safety of the students. The ramps are designed with considering EQUITABLE USE BUT REASONABLE and LOW PHYSICAL EFFORT principles to facilitate wheelchair users and students with visual disabilities.

Meanwhile, SIMPLE AND INTUITIVE USE principle is applied by the guiding path. The braille classroom signages are also proposed, but not implemented because of an absence of braille signs producer in Surabaya. Canopies are also offered for several school corridors but constructed by other donors. The shelters are also designed with the application of PROHIBITION OF USAGE ERROR principle. Lastly, adaptive toilet renovation is constructed with sitting toilet feature and railing. The adaptive toilet is designed to consider EQUITABLE USE BUT REASONABLE, LOW PHYSICAL EFFORT and PROHIBITION OF USAGE ERROR principles.

Figure 90 Proposed sliding windows and sliding door.

Figure 91 Construction of aluminium sliding door.

Figure 92 Construction of aluminium window protector to create safer corridors.

Figure 93 Proposed ramp and railings.

Figure 94 Construction of ramp and simple-rock-material-guiding path.

Figure 95 Proposed additional canopy.

Figure 96 Construction of adaptive toilet, with sitting toilet, anti-slip flooring and railing.

Proposed Ideal Design

The ideal design is also suggested to be developed in the future and supported by Provincial Government funding. Because of the school future needs, we propose a cluster of accessible classrooms. The classrooms are proposed with 1-meter-level-difference. The classrooms are designed for catering mix of students with visual disabilities and students with wheelchairs to fulfil the EQUITABLE USE BUT REASONABLE principle. The new classrooms are proposed in the space in the YPAB school for future school expansion. The school is also catered with ramps and stairs that have been designed properly. The ramps and stairs are designed with considering EQUITABLE USE BUT REASONABLE, LOW PHYSICAL EFFORT and PROHIBITION OF USAGE ERROR. The design stairs and ramps were improved using ADAAG 2010 standards. Non-slip floor materials, guiding paths and warning tiles are installed for reducing the slipping accidents and fulfil the PROHIBITION OF USAGE ERROR principle. The three-meter-width corridor canopy is also proposed for semi-outdoor student activities when it is raining. The more comprehensive canopy design also fulfils the EQUITABLE USE BUT REASONABLE, and PROHIBITION OF USAGE ERROR principles.

To increase safety and fulfil the PROHIBITION OF USAGE ERROR, sliding doors and sliding windows made from aluminium are provided. The sliding doors and windows are found better for safety measures during the design discussions. We selected prefabricated structure modules of RISHA to reduce the cost and increase construction speed. The protruding RISHA column in the corridor is solved with 1.5-meter railings and 0.8-meter additional vertical railings. The column edges are bevelled for fulfilling PROHIBITION OF USAGE ERROR principle. Additional storage, railings and guiding paths are also for orientation and mobility of YPAB students.

Another solution to the designs is the accessible toilet. The ADAAG-2010-standard toilet is proposed to serve two adjacent classrooms. The toilet designs applied four EQUITABLE USE principles but REASONABLE, SIMPLE AND INTUITIVE USE, LOW PHYSICAL EFFORT and PROHIBITION OF USAGE ERROR. Railings, sitting toilet, washing basin, anti-slip floorings, and other safety features are proposed. Fire alarm and safety alarm switch are also proposed to increase the PROHIBITION OF USAGE ERROR principle. Lastly, an accessible mirror is also provided to increase the wheelchair-users comfort level. To assist the low-vision students to understand the room depth, wall colouring from the floor level to 1.5-meter height. The blue colour is proposed to make contrasting with yellow railings and light orange wall colour.

Related to the thermal comfort, additional side vents, turbine roof vents, window ventilation are proposed. The thermal comfort also can be improved with vegetation in school environ. Lastly, the water-saving features are installed with roof gutters, vertical gutter, and water-tanks. The green solutions show that accessible school can also be green and cost-effective.

Figure 97 Ideal-accessible school floor plan (Explanation: 1. Teaching area, 2. Wheelchair-accessible seat, 3. Visually impaired seat, 4. Storage lockers, 5. Speaking computer, 6. Corridor, 7. Stairs, 8. Ramp, 9. Storeroom, 10. Greenery).

Figure 98 Perspective of building mass of Ideally-designed-accessible school.

Figure 99 Perspective of building mass of Ideally-designed-accessible school.

Figure 100 Perspective of building mass of Ideally-designed-accessible school.

Figure 101 Front elevation of Ideally-designed-accessible school.

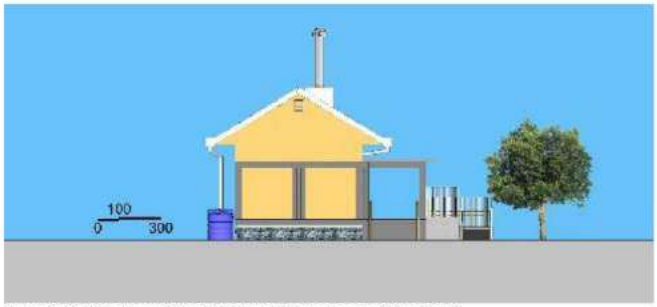

Figure 102 Side elevation of Ideally-designed-accessible school.

Figure 103 Back elevation of Ideally-designed-accessible school.

Figure 104 Section of Ideally-designed-accessible school.

Figure 105 Perspective of interior of classroom of the ideal school.

Figure 106 Perspective of interior of classroom of the ideal school.

Figure 107 Detail of sliding door of the ideal school.

Figure 108 Perspective accessible stairs of the ideal school.

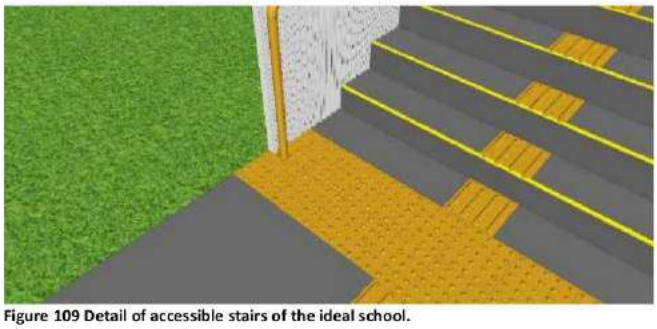

Figure 109 Detail of accessible stairs of the ideal school.

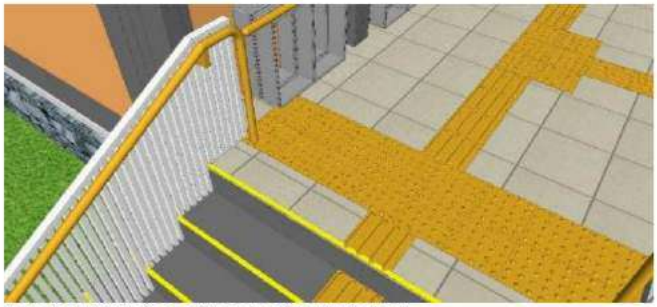

Figure 110 Detail of accessible stairs of the ideal school.

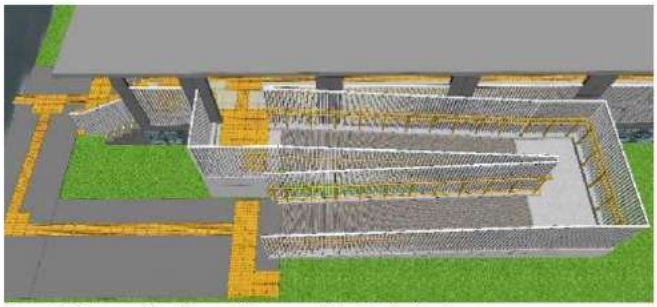

Figure 111 Perspective of accessible ramp of the ideal school.

Figure 112 Detail of guiding path in the ideal school ramps.

Figure 113 Detail of guiding path in the ideal school ramps.

Figure 114 Detail of accessible ramp of the ideal school.

Figure 115 Detail of guiding path in the ideal school ramps.

Figure 116 Detail of guiding path in the ideal school ramps.

Figure 117 Perspective of interior of toilets of the ideal school.

Figure 118 Perspective of interior of toilets of the ideal school.

Figure 119 Perspective of corridor of the ideal school.

Figure 120 Perspective of corridor of the ideal school.

Figure 121 Perspective of corridor of the ideal school.

Figure 122 Detail of storage area and railing in corridor of the ideal school.

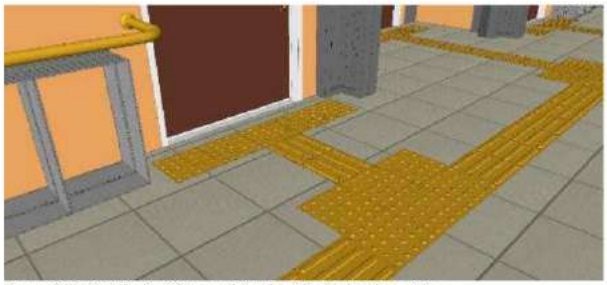

Figure 123 Detail of guiding path in the ideal school corridor.

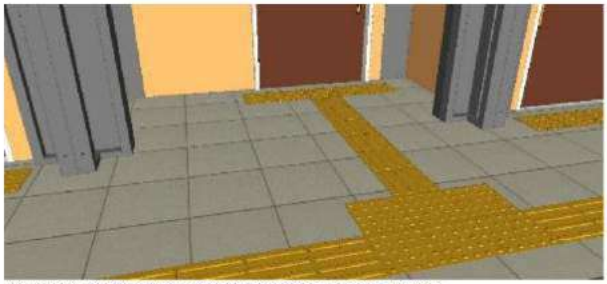

Figure 124 Detail of guiding path in the ideal school corridor.

Figure 125 Detail of classroom signage the ideal school.

Figure 126 Detail of toilet signage the ideal school.

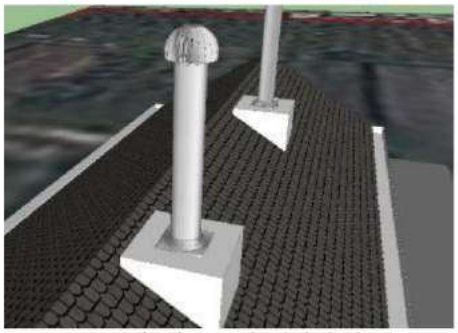

Figure 127 Detail of roof vent on the ideal school.

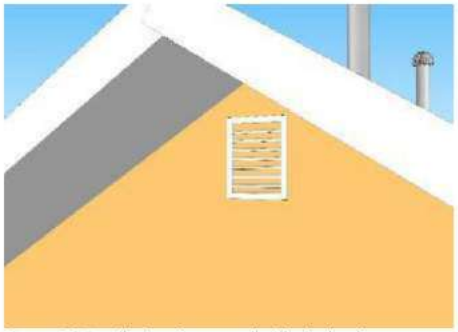

Figure 128 Detail of roof vent on the ideal school.

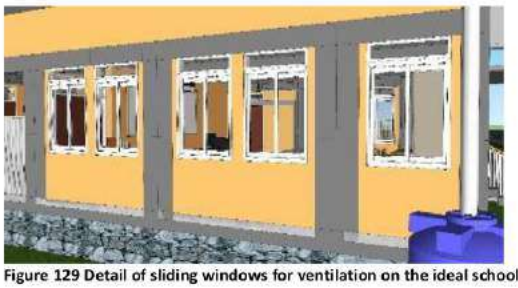

Figure 129 Detail of sliding windows for ventilation on the ideal school.

Figure 130 Detail of gutter and water tanks on the ideal school.

Figure 131 Detail of water tanks on the ideal school.

Chapter 5. Anti-Covid-19 Inclusive Design Concept

5.1. Anti-Covid-19 House Design Concept

Designed by:	Petra Christian University Team (Tim UK Petra): Gunawan Tanuwidjaja, S.T., M.Sc., IAI.
	SCIA Team (Tim SCIA): Stephen Yona Loanoto, S.T., M.Ars.; Jimmy Effendy Setiawan, S.T.; Devina Kartika Santoso, S.Ars, M.T.; Carissa Irene Putri, S.Ars.

In 2019-2020, we met the new architectural concept integrating the COVID disease with contamination controls within our spaces. As tuberculosis (TB) has created the modernist style in the 1930s, Covid-19 and lockdown must be considered in future architectural design. Because of Covid-19, our home has become the safest place than other public spaces, such as in the street, mass transportation, offices, schools, commercials, and religious buildings.

Limitation for accessible or visitable housings provision has been identified in some countries. In Australia, the liveable Housing Design guide was proposed by the housing industry and the Australian Government to answer The United Nations Convention of the Rights of People with Disabilities (UNCRPD) (Ward & Franz, 2015). However, the housing provision has not met the needs for accessible housing. Similarly, in Indonesia, we have limitation in providing accessible housing for people with disability and older populations (Japan International Cooperation Agency/ JICA, KRI International Corp. & Tekizaitekisho Llc., 2015). Therefore, we must create more options for people with disability and older people.

Older people homes are also considered as dangerous places because of Covid-19 attacks in several countries. In the USA, forty-three % of the USA Coronavirus Death are aged-care residents (54,000 residents) (The New York Times, 2020, June 27). Aged-care facilities are vulnerable because of shared facilities and condition of confined environments. Even though the aged-care home specification, is different from the intergenerational home in the Indonesian context, a similar approach needs to be integrated into the New – Normal Home concept.

A context of an inter-generational home is selected in high-income housing in Western of Surabaya. The land parcel is 12-meter x 30-meter and assumed in low-density housing neighbourhood. Three people are considered living in the house: an older woman and a younger couple. We are proposing a new rezoning and redesigning strategies in the new home. Several concepts were presented: controlling access for guests; separating the public and private areas; creating cleaning areas for users coming into the house; creating separate bathrooms for every bedroom for facilitating self-isolation; creating a number of green spaces and praying room inside the house.

Firstly, controlling access for guests is needed to prevent the spread of Covid-19. Many transmissions of Covid-19 is found happening from close-contacts. Understanding the Indonesian social meeting pattern, we need to create a different new-normal meeting room with clear windows but not facilitate direct contact or air-borne transmissions. Therefore, the guest room is separated from the host area by clear glass. This strategy is in line with three principles of Inclusive Design by Tanuwidjaja (2015) of PROHIBITION OF USAGE ERROR, SIMPLE AND INTUITIVE USE, and LOW PHYSICAL EFFORT. The location is preferred nearby the direct home access.

The second strategy selected for fighting Covid-19 is separating the public and private areas. This strategy is commonly known in the functionalist house. In the millennium, open plan houses are more popular, but due to Covid-19, the separation must be conducted to ensure the application of PROHIBITION OF USAGE ERROR. We also prepare the separation of services (kitchen and laundry room) from the internal living areas to ensure a safer environment.

Thirdly, we must create cleaning areas for sanitising users arriving in the house. The cleaning areas are facilitated for wheelchair users, older people, and other non-disability users. We make accessible toilets with standard accessible toilets. The cleaning areas are provided with implementing EQUITABLE BUT REASONABLE USE, SIMPLE AND INTUITIVE USE, LOW PHYSICAL EFFORT, and PROHIBITION OF USAGE ERROR.

Fourthly, if someone from the household is diagnosed with Covid-19, self-isolation can be conducted with strict-safe-and-health-protocol within the house. Separate bathrooms are provided for every bedroom for facilitating self-isolation. This strategy is conducted using LOW PHYSICAL EFFORT, and PROHIBITION OF USAGE ERROR to increase the rate of recovery from Covid-19. To stop the air-borne transmissions, the cross-ventilation is proposed with connecting green areas surrounding the house.

Lastly, to reduce the lockdown effect, we are proposing more green areas inside the house. The greenery also will help the well-being of the users. This strategy is in line with EQUITABLE BUT REASONABLE USE principle. Therefore, we need a larger plot to increase the well-being of homeowner during Covid-19. A praying room is also proposed to increase the Muslim user's religious well-being, despite the limitation of going to holy places. In conclusion, we need larger plots to mitigate Covid-19. We can create safer as well as a luxurious house in the design process.

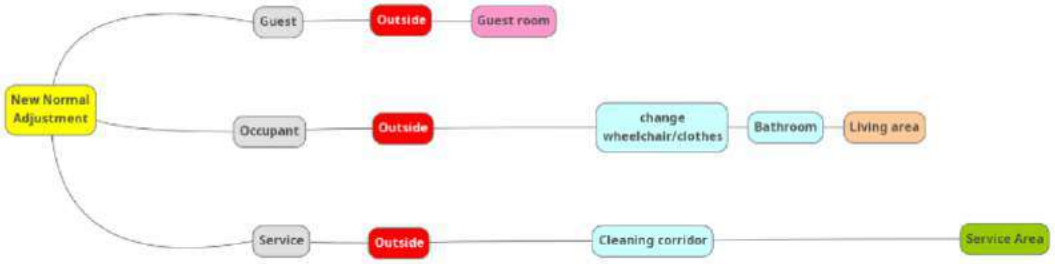

Figure 132 Zoning Concept.

Figure 133 Circulation Concept according to Zoning Concept.

Figure 134 Floor Plan (Explanation: 1. Parking area, 2. Guest room, 3. Cleaning area with bathroom, 4. Dining and Living room, 5. Kitchen, 6. Laundry, 7. First Bedroom (for older woman) with attached bathroom, 8. Second Bedroom (for an adult couple) with attached bathroom, 9. Prayer room with attached wudhu room, 10. Central garden, 11. Second garden).

Figure 135 General Axonometric (Explanation: 1. Parking area, 2. Guest room, 3. Cleaning area with bathroom, 4. Dining and Living room, 5. Kitchen, 6. Laundry, 7. First Bedroom (for older woman) with attached bathroom, 8. Second Bedroom (for an adult couple) with attached bathroom, 9. Prayer room with attached wudhu room, 10. Central garden, 11. Second garden).

Figure 136 Front Elevation.

Figure 137 Perspective of house from the front.

Figure 138 Perspective of New Normal Guest room.

Figure 139 Perspective of Cleaning area with bathroom.

Figure 140 Perspective of Cleaning area bathroom.

Figure 141 Perspective of Dining and Living room.

Figure 142 Perspective of Dining and Living room.

Figure 143 Perspective of Second garden.

Chapter 6

6.1. Conclusion of the Process

Stakeholders mostly developed of houses, apartments, and schools without considering needs of a minority or marginalized users. Person with disabilities, senior citizens and children were not facilitated because of their poor access to design process. Therefore, I propose to apply five new inclusive design principles, according to Tanuwidjaja (2015) such as:

- USER CENTERED
- EQUITABLE BUT REASONABLE USE
- SIMPLE AND INTUITIVE USE
- LOW PHYSICAL EFFORT
- PROHIBITION OF USAGE ERROR

This project was initiated by the Architecture Program Study and supported by United Boards in 2015-2016. The project later involved many stakeholders such as Visual Communication Design Program Study, Library@Petra, General Education Dept of PCU, and other important stakeholders. This collaboration shows that the successful design must include the owners, the marginalized users, and maintenance management. We need to adopt the Universal Design standard as prescribed by ADAAG 2010, Ministry of Public Works and People Housing no 14 the Year 2017 (PerMen PUPR no 14 Tahun 2017), etcetera. We need to include personal comments from the users to create and improve the barrier-free design into more inclusive designs.

This book facilitates the less mainstream users such as people with visual disabilities, people with cerebral palsies, people with locomotion disabilities and using wheelchairs, and older people with locomotion difficulties. The book discusses the renovation of existing home and schools; and further proposes new homes, apartments and schools. We hope that this book can advocate inclusive design process; and accessible-and-adaptive buildings for Government officials, owners, architects, designers, builders, and users. This book documented the advocacy process for people with disabilities and senior persons in Petra Christian University since 2013.

6.2. Reflection of the Process

by. Dr. Arina Hayati S.T., M.T.

According to Plowright (2020), architecture students see architecture as complicated, mysterious, or even difficult to be defined as architectural ideas. He proposes one way to approach architecture through understanding the human environment by investigating their perception and lived experience in their environment. Experiencing the environment may complex and multifaceted for disabled people. Thus, by exploring and understanding their wants and needs is necessary especially for architecture students. Environmental design for people with disability has been developed by introducing several design approaches such as accessible design, design for all, universal design, and inclusive design. Those approaches may vary on its principles and concepts, but all focus on increasing the environment more accessible, comfortable, and meaningful. Persson et. al (2015) describes the interest of developers and designers to accessible design increase when the number of aging and people with functional difficulties was significantly increased every year. Persson et. al. (2015) defines some design approaches or design thinking plays important roles, including Barrier-free design, Design for all, Universal design, Inclusive design, user-sensitive inclusive design/design for dynamic diversity, accessible design, universal access, and cooperative access. He also mentioned with many different approaches of designing for accessibility are becoming difficult to understand and adopt the concept into design implementation.

Universal design and Inclusive design have similarities, but both has different conception and philosophical background. Imrie and Hall (2001: 15-17) resume that universal design is a matter of developing and implementing a technical or design solution where it is promoting the flexibility, adaptability and interchangeability of fittings and fixtures to ensure 'an adaptable environment' to the broadest possible range of bodily shapes, dimensions, and movements. However, some questioned about such solution will cover different types of users, with contrasting design needs and the development of a social or political programme for change. For such limitation, according to Imrie and Hall (2001:3), inclusive design is much more than a technical response, but it also recognizes the necessary changes in the social relations of development and design processes. The link between inclusive design and universal design has been summarized by Wong (2014) presented in Table 2 below.

As mentioned in the previous chapter, the design principle used in this book are combined between Universal Design and Inclusive Design proposed by Tanuwidjaja (2015), includes 5 principles which are (1) User centred,

(2) Equitable use but reasonable, (3) Simple and intuitive use, (4) Low physical effort, and (5) Prohibition for usage error. The adopted principles are adjusted to socio-economic condition of users and their participation in the design process. The principles are not only used as design guidelines, but also as analysis tools for reading the case studies. Seven case studies are examined and cover not only various users' spectrum which are cerebral palsy, vision impairment, senior citizen, and locomotion limitation, but also different building function (housing and school). The proposal also covers designing inclusive housing that provides a resilient response to disease COVID-19 outbreak.

While seven buildings' design for special needs share similar design requirement that should consider full participation of the users, safety, flexibility, adaptability, and independent living; each design concept represents personal preferences, personal requirements, and design creativity. For example, Housing design for locomotor limitation was represented by 'a house for user with cerebral palsy', 'a house for senior citizen' and a house for wheelchair user. All design proposal highlights how the user can still move easily, manage their daily activities independently and ensure their safety and security throughout their entire lifetime. Personal requirement is shown by how all user requires different dimension and placement of housing fitting and fixture. For example, Fauzi with cerebral palsy requires semi-open plan spatial arrangement, the dimension and scale of housing fitting and fixture are above 10 cm that he can reach all the installed fitting and fixture easily, whereas for Syakur 'a wheelchair user' requires customized furniture, safe material and steady features that are wheelchair and children friendly. For Tutus who is total blind entails material textures, tactile markers, and fixed furniture location, whereas his wife who has low vision requires contrast level and the size, distance, and illumination of the object. Housing design for senior citizen considers not only fitting for physical activity and functional limitation, but also accommodates personal preference for independent living and socio-economic activities. The housing design promotes user safety with simple intervention and easily negotiated by their daily needs and activities. Beside considering 5 design parameters for inclusive housing design, a design responding the COVID-19 includes additional design requirement that prevent COVID-19 air-borne transmissions, such as cross ventilation and self-isolation bedroom and reduces the psychological impact of pandemic by providing green area and praying room.

For people with disability, owning a house on their own terms might be great challenge and rare opportunity. Moreover, standard of accessibility and home design guidelines for people with disability in Indonesia has not been well developed and research on housing design based on disabled people's perspective are less documented (except in Hayati, 2014; Hayati, et.al., 2017; Prastiti, et.al, 2020). According to Imrie (2004),

housing design for people with disability is not only characterised by adopting technical solution and physical standards, but further understanding the interrelationships between disability, impairment, and domestic architecture from lived experience lens is required. All case studies discussed in this book deal with complex design requirement, not only revealing users' needs and preference, but also includes the optimum design solution based on five principles of inclusive design. Therefore, this book offers adequate precedents that can be brought as starting point to understand domestic design from the perspective of people with disability and senior citizen. However, further exploration and investigation on lives experience of domestic environment with impairment are needed to understand the conception of housing. In addition, inclusive design should be embedded in architectural education and adopted as experiential learning within the curriculum for undergraduate architectural and design students (Mulligan. K et. al, 2018).

Table 2 Summary comparison of Inclusive Design and Universal Design from Wong (2014).

Inclusive Design	Universal Design
Principle 1: People	All seven principles. Though for ID, the focus is to incorporate all users and designers into the entire design process
Principle 2: Diversity	**Principle 1:** Equitable Use
Principle 3: Choice	**Principle 3**: Simple and Intuitive **Principle 6:** Low Physical Effort
Principle 4: Flexibility	**Principle 2:** Flexibility in Use
Principle 5: Convenient	**Principle 4**: Perceptible Information **Principle 5**: Tolerance for Error **Principle 6**: Size and Space for Approach and Use

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- Improving Accessibility of All Users in Petra Christian University Library (with UBCHEA, Aug 2016 – July 2017, https://desaininklusiukpetra.wordpress.com/2017/05/26/exhibition-of-improving-accessibility-of-all-users-in-library-petra/)

- UN-Habitat Prepcom 3 Parallel event with the title of Seminar and Field Visit: Inclusive Building and Urban Parks in Surabaya (in collaboration with UN-Habitat, Ministry of Public Works and the Public Housing Republic of Indonesia, Surabaya Municipality and Petra Christian University, July 2016, https://desaininklusiukpetra.wordpress.com/2016/07/12/inclusive-building-and-urban-parks-in-surabaya-trip/)
- Service Learning of Inclusive Design for Homes and Schools in Surabaya and Bandung, Participatory Design and Campaign (with UBCHEA, Aug 2015 – July 2016, https://desaininklusiukpetra.wordpress.com/2016/07/11/report-service-learning-of-inclusive-design-for-homes-and-schools-in-surabaya-and-bandung-participatory-design-and-campaign/)
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