CHAPTER III

RESEARCH METHODS

3.1 Research Methods

This research was carried out through a series of baseline studies, prototyping, and field tests, up until the final outcome; which is a Climate Change Education (CCE) learning kit for high school level teachers and students in Jakarta, Indonesia. The writer's role is to analyze the sample data from field testing with high school level teachers, carry out the duties within the graphic designer role in the prototyping stage of the learning kit's visuals, as well as being the research assistant to co-create the learning kit's content while closely following the "Climate Change Education Implementation Guide for Educational Units and Stakeholders" (Pendidikan Perubahan Iklim: Panduan Implementasi Untuk Satuan Pendidikan dan Pemangku Kepentingan Pengarah) released by Indonesian Education Standard, Curriculum, and Assessment Agency (BSKAP). Each research phase was conducted under KONEKSI Research Grant 2024-2025 Australia-Indonesia Extension and led by PREDIKT.

Empirical research is defined as conducting a systematic process of creating reliable information towards social phenomena using evidence sourced from experiences or observations (Smith, 2021). To reach the research objectives, the writer decided to pursue qualitative methodologies to provide an in-depth analysis of the target audience's standpoint and perspectives regarding the research object, which is the "GENERAKSI!" CCE learning kit for high school level teachers and students. To achieve this, a systematical research methodology must first be established. Universal Design Learning (UDL) will be used as the research's main analytical framework by translating it into themes and indicators produced by its 3 core principles. To utilize this framework, data analysis will be done through thematic analysis with a deductive data coding approach. Meanwhile, the design method of this research uses the Human Centered Design (HCD) approach, consisting of 3 phases: inspiration, ideation, and implementation. Each phase

consists of their own method combinations to reach their individual goals. To give a clear structure of the research's methodology, a research chart can be seen below which outlines the phases of HCD, chosen methods of each phase, as well as the output of each phase including data collection such as Focus Group Discussion (FGD) and questionnaires, and multiple iterations of the proposed design solution.

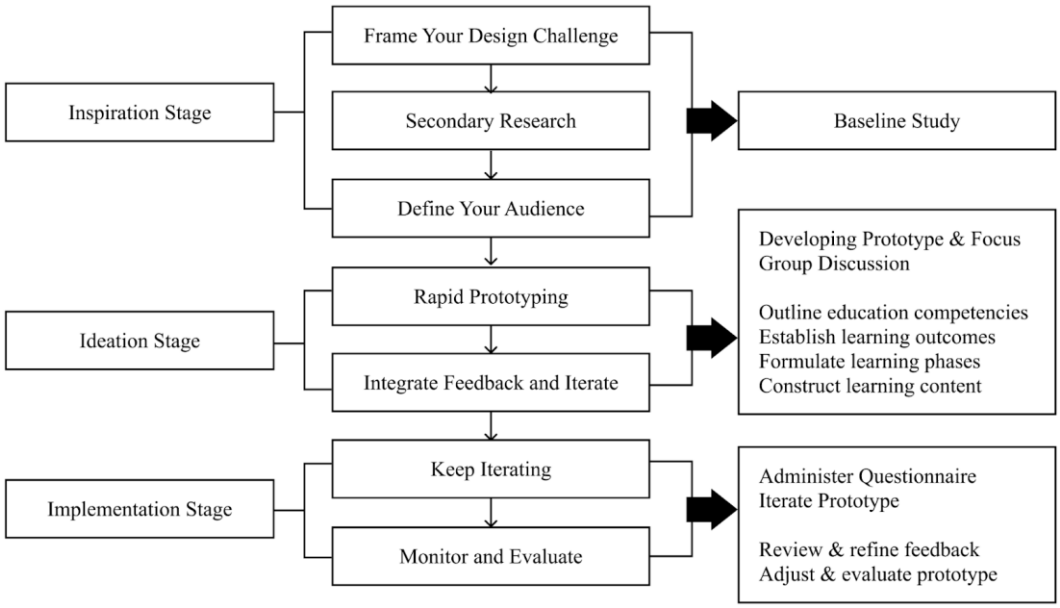

Figure 3.1 Research Outline

To conclude the research methodology overview, this research will utilize Human-Centered Design (HCD) as its design method approach, the Universal Design Learning (UDL) as the analytical framework, thematic analysis as the analytical tool for data analysis, while using data coding for its analysis instrument. HCD is further broken down into three phases, which are inspiration, ideation, and implementation, with each phase having its own set of methods.

3.2 Research Stages

Qualitative research is defined as a systematic methodology that emphasizes context, perspective, meaning, and subjectivity to dissect social phenomena by providing deep understandings about human-centered insights. (Lim, 2025). The prioritizes depth and richness examined within contexts of social phenomena, such as human interactions, behaviours, and perspectives. To support

this approach, Human-Centered Design (HCD) was selected as the primary design method due to its strong alignment with the research objective. HCD offers methodological flexibility while maintaining credibility in navigating complex social phenomena aspects. According to the Interaction Design Foundation, HCD is a practice to develop solutions towards problems for target audiences by gaining a deep understanding of the complex systems within their contexts, behaviours, and needs (IxDF - Interaction Design Foundation, 2021). This approach functions through empathy-based inquiries and is guided by its principles such as active user involvement, iterative design cycles, and multidisciplinary collaboration (Göttgens & Oertelt-Prigione, 2021).

HCD is widely adopted across multiple sectors to approach complex problem-solving scenarios, including healthcare, public services, and education. An example of its educational application is highlighted in a study by Saadeddine Shehab and Carol Guo, which demonstrated that HCD supports the development of problem-solving capabilities, resource identification, and enabling individuals in storytelling, time management, and collaboration (JohanssonSköldberg et al., 2013; Panke, 2019 as cited in Shehab & Guo, 2021). According to IDEO's "Field Guide to Human-Centered Design", HCD can be delivered by following three primary phases: inspiration, ideation, and implementation.

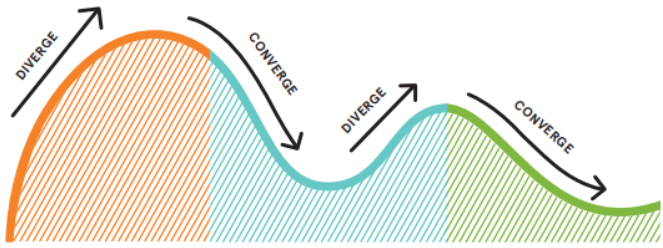

Figure 3.2 Human Centered Design (HCD) Processes in Three Phases

Source: IDEO (2015)

3.2.1 Inspiration Phase

The first phase of Human-Centered Design (HCD) is the inspiration phase. It focuses on generating insights by developing a deep understanding of the target audience's behavioural patterns, motivations, and contextual needs

to form the foundation of a solution. According to Kang et al. (2025), the first phase of HCD explores the challenges, perspectives, needs, and desires the target audience to create a roadmap for innovative solutions. In this research, 3 out of the 19 methods listed by IDEO's "Field Guide to Human-Centered Design" were proposed for the inspiration phase, which are *Frame Your Design Challenge*, *Secondary Research*, and *Define Your Audience*. These methods were chosen to support an exploratory study process aimed at identifying the design challenge, defining a clear and bounded research scope, analyzing the characteristics of the target audience, and reviewing existing data from relevant reports and literature for secondary research.

1) ***Frame Your Design Challenge***

This method aims to establish clear boundaries and direction for the design challenge embedded within a root problem. It typically utilizes structured guiding questions that help identify the root problem of the target audience, explore approaches toward a design challenge, examine contextual factors and limitations, and assess the desired impact of the design solution. Through this process, the design challenge becomes more intentful, practical, and grounded in the needs of the target audience. In the context of this research, it starts out by finding the What, Why, Who, Where, When, and How (5W+1H) of the root problem, which is limited engagement of climate actions within high school teachers and students across Indonesia.

2) ***Secondary Research***

In the context of Human-Centered Design (HCD), secondary research refers to a broader systematic search for human-centered insights obtained from journals, books, reports, news sources, and other published literature. It aims to strengthen foundational understanding of a design challenge by identifying patterns, gaps, and insights in the existing data. Secondary research can be used to bridge knowledge gaps inside primary data, or serves as the

groundwork to design an effective primary data collection strategy. The strategy for secondary research can be seen in later parts of this research, but to conclude, secondary research was done by selecting peer-reviewed literature from academic or institutional sources and uses certain keywords such as “climate change”, “climate change education”, and "interactive learning”.

3) Define Your Audience

There are multiple approaches towards defining an audience, such as user personas, empathy mapping, user journey mapping, behavioral archetypes, and STP (Segmentation, Targeting, and Positioning) model. STP is commonly used in marketing to decide appropriate approaches towards the target market by observing the social behaviors of the audience. In the context of this research, the target audience’s demographic, geographic, and psychographic data was explained to gain an impression of the target audience’s behaviours. In this case, it was high school level teachers and students residing in Jakarta.

3.2.2 Ideation Phase

The second phase of Human-Centered Design (HCD) is the ideation phase. It focuses on generating and developing ideas derived from the insights obtained during the inspiration phase. This phase consists of a series of steps toward creating early versions of the final design solution. These steps may include organizing the large volume of gathered data, identifying opportunities for design solutions, and obtaining feedback to refine emerging prototypes. Out of the 24 available methods in the ideation phase, this research selected 2 methods which are *Rapid Prototyping* and *Integrate Feedback and Iterate*. These methods focus on the conceptualization, prototyping, and iteration that allows for flexibility within the development of a design solution.

1) Rapid Prototyping

Rapid Prototyping is where the design solutions generated from previous steps are made into tangible forms, such as the

Climate Change Education (CCE) learning kit filled with activity worksheets. The prototypes from this method are meant to convey the key ideas quickly while being flexible enough to incorporate iterations from the target audience's feedback. According to Figma, rapid prototyping can be done through three main steps, which are build, review, and refine (Figma, n.d.). The build step produces the tangible design solution prototype, meanwhile the review and refine steps are to quickly test and adjust as feedback is gained. By doing Rapid Prototyping, ideas are able to be validated quickly and work backtracking can be avoided.

2) ***Integrate Feedback and Iterate***

Insights gained from feedback are then integrated back to the existing prototype, guiding the iteration process to better cater the needs of the target audience. The prototype will continuously take on multiple iterations, with iterating and reapplying feedback insights whilst creating changes to the design solution. Constant iterations is one of HCD's core principles. As mentioned in IDEO's "Field Guide to Human-Centered Design", Gaby Brink, the founder of Tomorrow Partners stated that "by iterating, we validate our ideas along the way because we're hearing from the people we're actually designing for." (IDEO, 2015).

3.2.3 Implementation Phase

The final phase of Human-Centered Design (HCD) is the implementation phase. The final prototype from the previous phase transforms into the implemented solution within the real life conditions and situations of the target audience. While the solution is already implemented, this phase still allows for feedback and occasional iterations, and simultaneously evaluating the progress and effectiveness of the solution towards the identifiable problems. The available 14 methods of this phase were systematically chosen according to the progress of the previous phase's output. This research chose 2 methods of: Keep Iterating and Monitor and Evaluate.

1) Keep Iterating & Monitor and Evaluate

By this stage, the design solution has gone through multiple iterations, nearing its finalized version. Through the gathered feedback insights, the methods Keep Iterating and Monitor and Evaluate pushes the design solution to fully utilize its flexibility to accommodate the target audience's needs. By pushing the design solution, the level of impact it gives becomes more identifiable in the field. Hence, effective iterations could be produced more to fit the design challenge and the target audience.

To conclude the explanation of this section, this research utilizes a variety of 3 and 2 methods in each phase of the Human-Centered Design (HCD) approach. In the inspiration stage, the methods Frame Your Design Challenge, Secondary Research, and Define Your Audience are used to create a foundational base for the Climate Change Education (CCE) learning kit by exploring the social framework of the target audience. In the ideation stage, the methods Rapid Prototyping and Integrate Feedback and Iterate are used to develop early frameworks of the design solution, leading close-to-final iterations based on the feedback collected in this phase. Lastly, the implementation phase employs Keep Iterating and Monitor & Evaluate to implement the final iteration of the design solution in real-life conditions while continuously gathering feedback and producing iterations.

3.3 Qualitative Data Collection Techniques

Following the methodology framework outlined in earlier parts of this study, this section details the qualitative data collection techniques utilized within the Human-Centered Design (HCD) approach. Qualitative data is essential in this research because the research objective centers around the efficacy of a learning tool designed to support students' personal development toward climate action, a process that is inherently social and contextual. The qualitative data collection of this research was carried out using the techniques of *Secondary Research, Focus Group Discussions (FGD), and a Qualitative Questionnaire*. Throughout the FGD

and questionnaire data collection, the participant sampling is based on considerations of where the Climate Change Education (CCE) learning kit will be used for, which are formal high school level education curricula. Hence, the FGD will include experts of Indonesia's formal education system curriculums, whereas the questionnaire includes high school level teachers from multiple schools around Jakarta to match the research scope that was previously established. Lastly, the data collection of this research was ethically carried out under the supervision of the supervising lecturer from Universitas Multimedia Nusantara (UMN), and PREDIKT as the main initiator and carrier of this research branch supported by KONEKSI's extended research grant 2024-2025.

3.3.1 Inspiration Phase

The primary qualitative data collection technique used in this Human-Centered Design (HCD) phase is Secondary Research. According to Scribbr, secondary research is defined as a technique that uses existing data aimed "to explain the causes and consequences of a well-defined problem" (George, 2023). To conduct the technique, the scope inquiries, search strategy, source selection criterias, and evaluation method of the sources must first be explained to prove the reliability and validity of the technique's output.

Secondary Research was conducted during the inspiration phase of Human-Centered Design (HCD) to discover existing relevant studies and establish the baseline data about the research's topic: climate change. A guideline developed by the Association for Strengthening Agricultural Research in East and Central Africa (ASASRECA) defined baseline data as gathered sets of information before initiating a program or project (ASARECA, 2010 as cited in Ssekamatte & Moses, 2015).

The writer conducted secondary research from 25th August 2025, and has the goal of limiting it up until 10th September 2025. The sources were to be searched using academic search engines and public databases. The search process will involve reviewing peer-reviewed journal articles, conference proceedings, governmental & organizational reports, and credible institutional

websites, using the following collection of keywords correlating to the research topic.

Table 3.1 Secondary Research Keyword Collection

Themes	Keywords

Climate Change Phases according to Sekarwulan et al., (2024)	• Climate change conditions
	• Climate change causes
	• Climate change impacts
	  ○ Towards healthcare
	  ○ Towards the environment
	  ○ Towards agriculture
	  ○ Towards social-economy
	  ○ Environmental consequences
	• Climate change adaptation and mitigation

Climate Change Education (CCE)	• Climate change initiatives
	  ○ Climate change education
	  ○ Climate action

Indonesia Formal Education & Learning Tools	• Formal high school education in Indonesia
	• Interactive learning
	  ○ Game-based learning
	• Learning tools
	  ○ Learning kits

Following along, the selection of sources followed the inclusion criteria of: (1) relevance to climate change, Climate Change Education (CCE), or formal education & education tools topics, (2) published peer-reviewed literature within 10 years, and (3) proven publications sourcing from academic or institutional platforms. The selected sources will then be analyzed using descriptive synthesis to identify foundational concepts and theories, and research gaps and opportunities that prepares the next stage of the HCD

approach, which is the ideation phase using Focus Group Discussion (FGD) as its primary data collection technique.

3.3.2 Ideation Phase

Within this phase, a Focus Group Discussion (FGD) was conducted alongside the prototype of the Climate Change Education (CCE) learning kit to gain early-stage validation of the design solution. FGD is a qualitative data collection technique conducted with a group of a specific number of people discussing a topic while being overseen by a moderator. It aims to gather in-depth insights present within the participants responses, perceptions, beliefs, and attitudes (Shabina et al., 2024). This research's FGD was planned with gaining participants' expertise on Indonesia's formal high school education curricula. Its goal is to gather feedback towards the content of the CCE learning kit in terms of its applicability and usability inside Indonesia's formal education sphere. To prepare this data collection, questions were made based on the Universal Design Learning (UDL) three core principles, which were Engagement, Representation, and Action & Expression.

3.3.3 Implementation Phase

The primary qualitative data collection method throughout the entire Human-Centered Design (HCD) approach is the questionnaire used in the implementation phase. Questionnaires allow for quick data collection from a set of individuals using close-ended questions or open-ended questions. For the purpose of this research, the questionnaire uses a series of open-ended questions which offers deeper insights into the knowledge and opinions of the participants (Hahn, 2024). To synthesize a reliable questionnaire, themes or categories can be formulated from deducting the research objectives and HCD criterias to properly measure the research object's factors in reliability and scalability of its implementation in the field. Aside from themes, consulting the pre-made questions to an expert could also help in ensuring its quality and validity. In this case, the writer has consulted the questionnaire to the supervising lecturer of this research before giving them out to the participants.

The questionnaire used in this phase are planned to be given to high school level teachers, and is filled with open-ended questions categorized into 6 different themes, based on the Climate Change Education (CCE) learning kit aspects which are: (1) the alignment and relevance of content, (2) inclusivity and gender equality, (3) use for teachers, (4) interactivity and involvement, (5) implementation and scaling, lastly (6) monitoring and feedback. The desired data from the open-ended questions were to provide the participants with freedom of input towards the previously mentioned themes that are tested within the CCE learning kit. By consulting directly to teachers, the research gains direct feedback of the CCE learning kit's strengths and drawbacks from expert opinions.

3.4 Data Analysis Techniques

Data analysis will be carried out using a combination of UDL, thematic analysis, and data coding. UDL acts as the analytical framework, creating indicators that help direct the hybrid data coding process in thematic analysis. Thematic analysis was chosen as the data analytical tool because it enables systematic pattern identification within qualitative data while accommodating both inductive and deductive coding based on existing theoretical constructs, such as UDL. From the hybrid approach, inductive data coding is executed through identifying patterns and creating codes from the gathered data, and deductive data coding comes from UDL's framework principles and indicators. The resulting codes will then be grouped to create themes that will be interpreted to assess the extent of the Climate Change Education (CCE) learning kit's flexibility, accessibility, and pedagogical responsiveness. These insights will guide the refinement of the learning kit with better guiding capabilities towards students to increase their engagement in taking climate actions, by fueling them through CCE in a formal education setting.

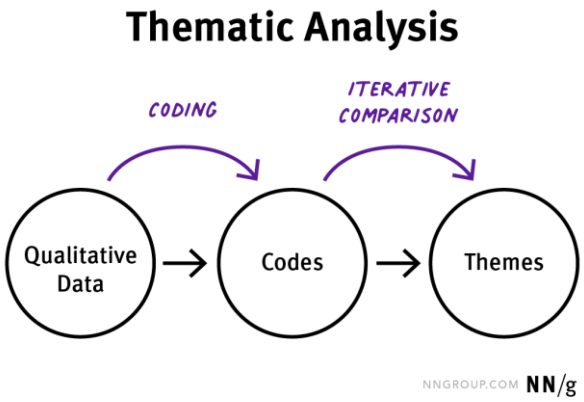

Figure 3.3 Thematic Analysis Diagram

Source: Rosala (2022)

According to the Center for Applied Special Technology (CAST), UDL is a framework used to improve the learning experiences across different individuals and environments by fostering inclusive and meaningful participation (CAST, n.d.). As explained by CAST, UDL is organized in two ways: (1) horizontally, which includes its three core principles of Engagement, Representation, and Action & Expression, and (2) vertically with access, support, and function.

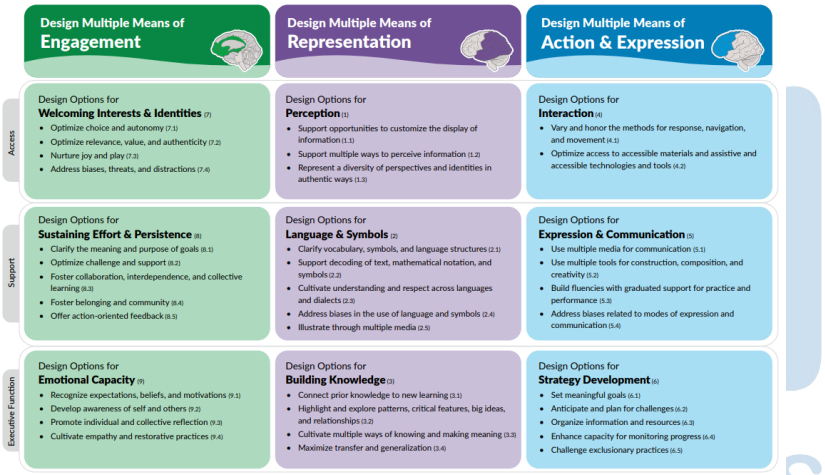

Figure 3.4 The UDL Framework

Source: CAST (2024)

Although UDL is widely applied in many educational pedagogies, its impact on secondary level education participants has yet to be explored as such. An empirical study conducted by Bray et al. (2023) revealed a research gap of the Engagement and Action & Expression principles of UDL applications towards secondary level education, resulting in important non-addressed skills towards students self-development such as student self-regulation and sustaining effort persistence. CAST realized these gaps, hence an UDL guideline is publicized to discover the potential of its applications inside diverse levels and forms of education towards diverse types of participants. This guideline can be accessed publicly, and will be used for the following data analysis of this research.

UDL's guidelines listed three core principles comprising Engagement, Representation, and Action & Expression as the vertically structured organizers. These principles are then taken into the framework's horizontal structure with three guidelines to support learners in access, support, and function. Each principle is then used to support educators in addressing the diversity of learning. When UDL's principles are examined further, its indicators towards an inclusive and engaging learning experience can be provided to guide this research.

- **Engagement** (the why of learning): motivation and interest towards learning, effort persistence, and multiple options for engagement.
- **Representation** (the what of learning): how to perceive information as meaning, different approaches for special-needs learners, multiple representations and perspectives.
- **Action & Expression** (the how of learning): expression of ideas, self expression, learning processes & environment.

These principles and indicators are then used for analytical purposes, and also to ensure the validity of data collection instruments that were previously used in the ideation and implementation phases of Human-Centered Design (HCD). The primary data collection instruments, which are questions for a questionnaire in the implementation phase of HCD, were constructed to closely adhere to the principles and indicators present in the three core principles of UDL.