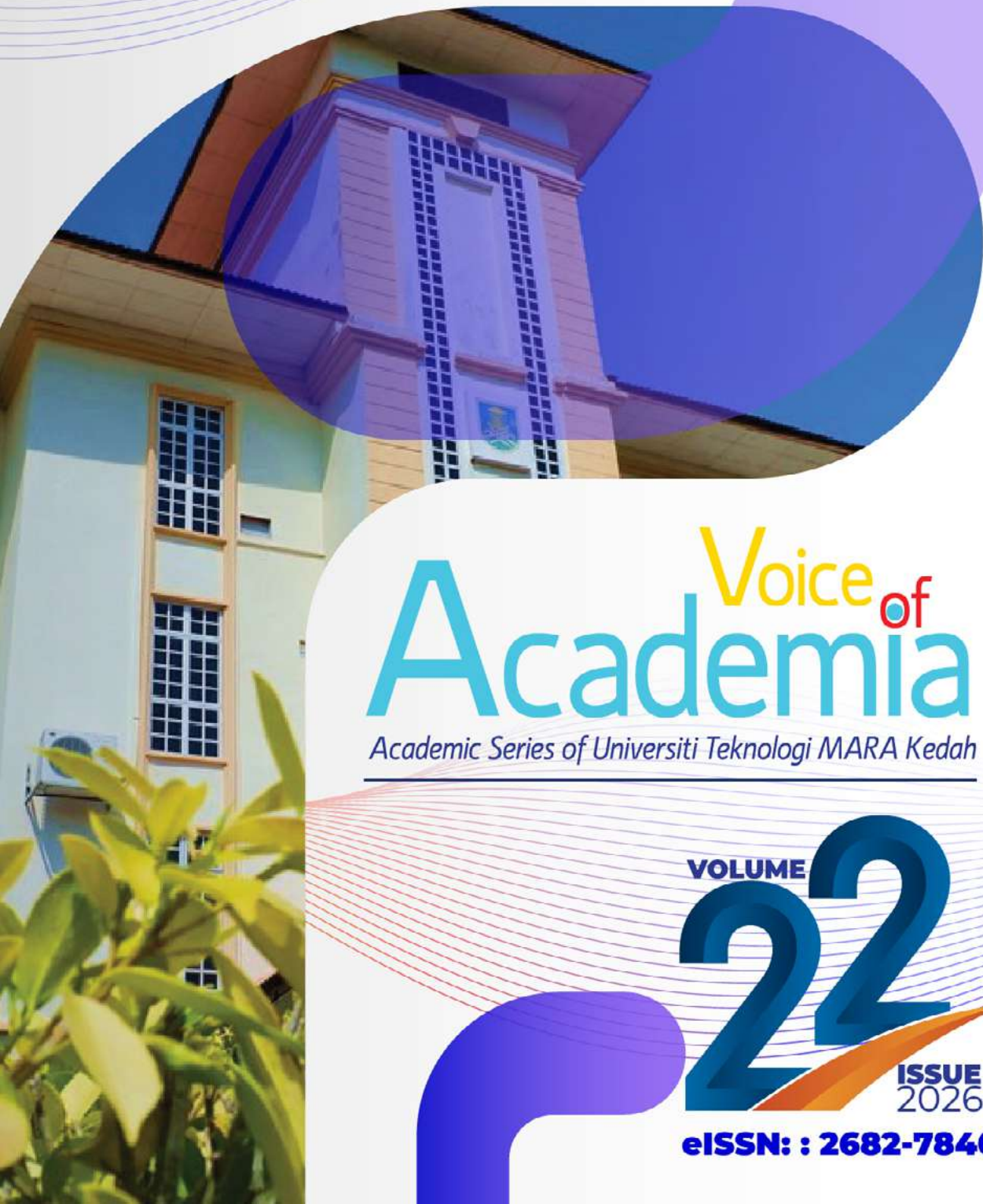




UNIVERSITI
TEKNOLOGI
MARA



Voice of Academia

Academic Series of Universiti Teknologi MARA Kedah

VOLUME

22

ISSUE 1
2026

eISSN: : 2682-7840

ADVISORY BOARD MEMBER

PROFESSOR DR. ROSHIMA HAJI. SAID ASSOCIATE
PROFESSOR DR MOHD RIZAIMY SHAHRUDDIN

CHIEF EDITOR

DR. JUNAIDA ISMAIL

MANAGING EDITOR

MOHD NAZIR RABUN

COPY EDITOR

SYAHRINI SHAWALLUDIN

EDITORIAL TEAM

SAMSIAH BIDIN
ETTY HARNIZA HARUN
INTAN SYAHRIZA AZIZAN

EDITORIAL TECHNICAL TEAM

KHAIRUL WANIS AHMAD
MAZURIAH AHMAD

EDITORIAL BOARD

PROFESSOR DR. DIANA KOPEVA,

UNIVERSITY OF NATIONAL AND WORLD ECONOMY,
SOFIA, BULGARIA

PROFESSOR DR. KIYMET TUNCA CALIYURT,

FACULTY OF ACCOUNTANCY,
TRAKYA UNIVERSITY, EDIRNE, TURKEY

PROFESSOR DR. M. NAUMAN FAROOQI,

FACULTY OF BUSINESS & SOCIAL SCIENCES,
MOUNT ALLISON UNIVERSITY, NEW BRUNSWICK, CANADA

PROFESSOR DR. SIVAMURUGAN PANDIAN,

SCHOOL OF SOCIAL SCIENCE,
UNIVERSITI SAINS MALAYSIA (USM), PULAU PINANG

PROF. DR SULIKAH ASMOROWATI,

FISIP, UNIVERSITAS AIRLANGGA (UNAIR),
SURABAYA, INDONESIA

DR. IRA PATRIANI,
FISIP, UNIVERSITAS TANJUNGPURA (UNTAN),
PONTIANAK, INDONESIA

DR. RIZAL ZAMANI IDRIS,
FACULTY OF SOCIAL SCIENCE & HUMANITIES,
UNIVERSITI MALAYSIA SABAH (UMS), SABAH

DR. SIMON JACKSON,
FACULTY OF HEALTH, ARTS AND DESIGN,
SWINBURNE UNIVERSITY OF TECHNOLOGY MELBOURNE, AUST

DR. AZYYATI ANUAR,
FACULTY OF BUSINESS MANAGEMENT,
UNIVERSITI TEKNOLOGI MARA (UITM) KEDAH BRANCH, MALAYSIA

DR. FARYNA MOHD KHALIS,
COLLEGE OF CREATIVE ARTS,
UNIVERSITI TEKNOLOGI MARA (UITM) SHAH ALAM, MALAYSIA

DR IDA NORMAYA MOHD NASIR,
FACULTY COMPUTER SCIENCE AND MATHEMATICS,
UNIVERSITI TEKNOLOGI MARA (UITM) KEDAH BRANCH, MALAYSIA

DR MOHD FAIZAL JAMALUDIN,
FACULTY OF ACCOUNTANCY,
UNIVERSITI TEKNOLOGI MARA (UITM) KEDAH BRANCH, MALAYSIA

DR. MUHAMAD KHAIRUL ANUAR ZULKEPLI,
ACADEMY OF LANGUAGE STUDIES,
UNIVERSITI TEKNOLOGI MARA (UITM) KEDAH BRANCH, MALAYSIA

DR NOR ARDIYANTI AHMAD,
FACULTY OF ADMINISTRATIVE SCIENCES & POLICY STUDIES,
UNIVERSITI TEKNOLOGI MARA (UITM) KEDAH BRANCH, MALAYSIA

e-ISSN:2682-7840



Copyright © 2026 by the Universiti Teknologi MARA Press

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or any means, electronic, mechanical, photocopying, recording or otherwise, without prior permission, in writing, from the publisher.

© Voice of Academia is jointly published by the Universiti Teknologi MARA Caawangan Kedah, Malaysia and Penerbit UiTM (UiTM Press), Universiti Teknologi MARA Malaysia, Shah Alam, Selangor.

The views, opinions and technical recommendations expressed by the contributors and authors are entirely their own and do not necessarily reflect the views of the editors, the Faculty or the University.

TABLE of CONTENTS

FORECASTING THE MALAYSIAN RINGGIT (MYR) EXCHANGE RATE: ARIMA VS GARCH Rabi'atul Adawiyah Muhamad Shah & Nurul Nisa' Khairol Azmi*	1 - 16
BEHIND THE SCREEN: A SYSTEMATIC REVIEW OF CONTEMPORARY CHALLENGES IN DIGITAL LEARNING Siti Noorsiah Jamaludin ¹ , Abd Samad Hasan Basari ²	17 - 36
INVESTIGATING THE EFFECTIVENESS OF COLLABORATIVE LEARNING STRATEGIES IN MASTERING THE ARABIC LANGUAGE Abd Rahman Jamaan*	37 - 52
IMPLEMENTING CLAY SCULPTING AS AN IDEATION STRATEGY IN TEACHING PRODUCT FORM DESIGN TO FIRST-YEAR INDUSTRIAL DESIGN STUDENTS Mohd Hamidi Adha Mohd Amin ¹	53 - 68
EXPLAINING ENTREPRENEURIAL INTENTION OF MALAYSIAN PUBLIC UNIVERSITY STUDENTS: THE MEDIATION MODERATED MODEL Ahmad Nabil Mohd Zahariman ¹ , Nur Fatin Syazliana Zahar ² , Nurul Hidayana Mohd Noor ^{3*} & Syeliya Md Zaini ⁴	69 - 88
SUPPLIER SELECTION OF HALAL KOREAN RESTAURANT USING FUZZY TOPSIS Norpah Mahat ¹ , Nurul Aqilah Ahmad ²	89 - 102
RAINFALL INTENSITY CLASSIFICATION IN SUBANG Mohamad Aiman Hakim Mohamad Nizam ¹ , Isnewati Ab Malek ^{2*} & Jaida Najihah Jamidin ³	103 - 116
SYNCHRONOUS AND ASYNCHRONOUS CORRECTIVE FEEDBACK FOR GRAMMAR ACCURACY: ESL NOVICE TEACHERS' BELIEFS AND PRACTICES Aiman Zulaikha Mohd Fadzli ¹ , Sheela Faizura Nik Fauzi ^{2*} & Abdul Azim Mahda ³	117 - 130
DIGITAL SPORTS GRAPHICS AND BRAND PERSONALITY IN THE MALAYSIAN SEPAK TAKRAW LEAGUE Muhammad Asyraf Hanafi ¹ , Neesa Ameera Mohamed Salim ^{2*} & Azhar Abd Jamil ³	131 - 142
TOWARDS INCLUSIVE GAMIFIED LITERACY INTERFACES FOR MALAYSIAN STUDENTS WITH DYSLEXIA: INTEGRATING THE DELONE AND MCLEAN INFORMATION SYSTEMS SUCCESS MODEL Safura Adeela Sukiman ^{1*}	143 - 163
UNDERSTANDING RECYCLING BEHAVIOR: A STUDY ON UITM SEGAMAT STUDENTS Nur Diana Zaman ¹ , Fatin Farazh Ya'acob ^{2*} , Basri Badyalina ¹ , Muhammad Zulqarnain Hakim Bin Abd Jalal ¹ , Amir Imran Zainoddin ² & Kerk Lee Chang ¹	164 - 176
DOES FDI BENEFIT ALL? EXAMINING INCOME INEQUALITY ACROSS 10 ASEAN NATIONS Bee-Hoong Tay ^{1*} , Nurulrahwani Hamsan ² , Nurul Dhihani Md Idris ³ & Nurul Hafizzati M Roslee ⁴	177 - 190
MESOPOTAMIAN ARCHITECTURE AS BACKGROUND DESIGN IN CONTEMPORARY ANIMATED SERIES Nureen Qistina Affandi ¹ , Siti Nur Ain Abd Rahman ^{2*}	191 - 209

TRANSFORMING HRM EDUCATION THROUGH VALUES-BASED PEDAGOGY: THE ADAB+ APPROACH AND CORPORATE RELEVANCE	210 - 224
Muhammad Aiman Awalluddin ¹ , Anisa Safiah Maznorbalia ² & Mohd Ramlan Mohd Arshad ³	
COMPARATIVE ANALYSIS OF PSEUDOCODE AND FLOWCHARTS IN ALGORITHM DEVELOPMENT AMONG FIRST-YEAR COMPUTER SCIENCE STUDENTS	225 - 239
Satria Arjuna bin Julaihi ¹ , Zubaidah binti Bohari ² , Rumaizah binti Che Md Nor ³ & Abdul Hadi bin Abdul Talip ⁴	
EXPLORING THE STUDENT PERCEPTION OF ACRONYM-BASED LEARNING APPROACH IN LEARNING ACCOUNTING PRINCIPLES AMONG NON-ACCOUNTING MAJOR STUDENTS	240 - 258
Siti Aimi Mohamad Yasin ¹ , Corina Joseph ^{2*} & Nur Izyan Ismail ³ , Nuraisyah Fitrié Abdullah@Abd Jalil ⁴ , Azmira Abdullah ⁵	
ZAKAT DISTRIBUTION DECISION BASED ON FUZZY EVALUATION APPROACH	259 - 272
Zamali Tarmudil ¹ , Noor Syazana Ngarisan ^{2*} & Muhammad Yassar Yusri ³	
LEAN PRACTICES IN CONSTRUCTION: A COMPREHENSIVE LITERATURE REVIEW ON ENHANCING PROJECT PERFORMANCE	273 - 284
Syed Nasrul Fadzli Syed Mohamad ^{1*} , Mohd Shahnaz Bin Mahbook Ali ² & Amir Ahzlina Jasni ³	

IMPLEMENTING CLAY SCULPTING AS AN IDEATION STRATEGY IN TEACHING PRODUCT FORM DESIGN TO FIRST-YEAR INDUSTRIAL DESIGN STUDENTS

Mohd Hamidi Adha Mohd Amin^{1*}

¹ Faculty of Art & Design, Universiti Teknologi MARA Cawangan Kedah,

ARTICLE INFO

Article history:

Received August 2025
Accepted August 2025
Published Jan 2026

Keywords:

Clay Modeling, Form
Exploration, Hands-on
Learning, Ideation, Industrial
Design Education

Corresponding Author:
*hamidiadha@uitm.edu.my

ABSTRACT

This study investigates the use of clay sculpting as a hands-on ideation strategy in teaching product form development to first-year industrial design students. A qualitative, studio-based approach was employed involving 17 students, from which 5 were purposively selected to represent diverse form outcomes. Data were collected through observations, photographic documentation, and analysis of clay models and sketches. Using open coding and visual analysis, the study identified three key themes: (1) clay sculpting encouraged exploration of unconventional product forms beyond typical walkie-talkie archetypes, (2) subject matter inspiration supported structured abstraction and meaningful form translation, and (3) the physical-to-visual sequence improved students' understanding of proportion, usability, and design refinement. The results indicated that clay sculpting expanded students' form exploration and strengthens their ability to interpret inspiration sources and apply them in a clear design direction. It also promoted creative risk-taking, reduces design fixation, and strengthens form reasoning in early design education. Overall, this study provides evidence that tangible ideation effectively supports the transition from abstract exploration to functional product concepts, offering practical value for foundational design education.

©2026 UiTM Kedah. All rights reserved.

1. Introduction

Form exploration is a fundamental component of early industrial design education because it helps students develop sensitivity toward shape, proportion, and three-dimensional reasoning (Chugh & Tiwari, 2024; Corremans, 2011). However, beginner students often struggle to generate original forms when relying solely on visual references or digital tools. Such dependence

typically leads to predictable or repetitive outcomes, a problem associated with design fixation (Viswanathan & Linsey, 2012). This issue becomes evident when students are tasked with designing familiar products, where existing archetypes tend to dominate their imagination. Research highlights that hands-on, material-based approaches can support deeper form understanding by engaging both visual and tactile senses (Charlesworth, 2007). Physical modeling also aligns with embodied cognition, where creative insight emerges through direct interaction with materials and real-time sensory feedback (Ramduny-Ellis et al., 2010; Lyche & Øverjordet, 2021). These methods help students “think through making,” allowing iterative refinement as part of the ideation process (Stevens, 2024). Compared to screen-based exploration, physical manipulation encourages more natural adjustments to volume, curvature, and balance, enabling learners to discover form possibilities beyond conventional or familiar shapes.

Clay sculpting is widely regarded as an effective ideation medium for early design learners due to its flexibility, affordability, and ability to support spontaneous exploration (Memikoğlu et al., 2015). Prior studies show that working with clay enhances students' understanding of proportion and curvature and enables them to externalize abstract ideas in three-dimensional form (Chugh & Tiwari, 2024). Despite these advantages, the effectiveness of clay sculpting as an ideation tool within structured product design tasks especially at the beginner level, remains underexplored in the industrial design education literature. Responding to this gap, this study investigates the use of clay sculpting as a hands-on ideation strategy for a studio project where first-year students were tasked with designing a walkie-talkie featuring unique and unconventional form characteristics. The project required students to draw inspiration from natural or man-made subject matter, translate these references into abstract clay explorations, and subsequently refine them into functional product forms. This instructional approach aligns with experiential learning models that emphasize learning through physical engagement, iterative making, and reflective decision-making (Gürsoy, 2018; Su & Phanhabutr, 2024).

Problem Statement

In the early stages of industrial design education, students are often introduced to ideation methods that rely heavily on visual references and sketching. Although these techniques are useful, they can also accidentally constrain creative thinking, as students often replicate current designs instead of creating new shapes. This issue frequently occurs when students are tasked with designing familiar products, such as electronic devices, where existing forms dominate their imagination (Cardoso & Badke-Schaub, 2011; Viswanathan et al., 2012). First-year design students also often lack the skills to reinterpret everyday objects into new and meaningful forms (Kuhns, 2024). As a result, their designs may become repetitive or overly dependent on existing visual references. Moreover, traditional classroom methods tend to emphasize two-dimensional ideation while overlooking hands-on exploration opportunities that are crucial for developing form literacy (Jensen, 2004; Hill & Baker, 2016).

The absence of three-dimensional, material-based ideation limits students' ability to understand proportion, volume, and tactile relationships, skills which are essential for early form development. Without physical interaction, students struggle to break away from design fixation and rarely produce expressive or unconventional design outcomes. Clay sculpting presents a potential solution to these challenges by offering a physical, responsive, and intuitive medium for ideation. It introduces a hands-on approach that emphasizes size, proportion, and three-dimensional manipulation. However, its effectiveness as an ideation tool for early design students remains under-explored, especially in the context of structured product design tasks in industrial design education. Existing studies seldom examine how clay sculpting influences the transition from

abstract exploration to functional form refinement, leaving a gap in understanding its pedagogical value in beginner-level studio settings. This study addresses this gap by examining how clay sculpting impacts the development of imaginative forms, supports the use of subject matter as inspiration, and enhances the overall ideation process in a walkie-talkie form exploration project for first-year students.

Aim and Objectives of the Study

This study aims at exploring the role of clay sculpting as a hands-on ideation strategy for developing creative and original product forms in early-stage industrial design education. To achieve this aim, the study focuses on three interconnected objectives:

1. To investigate how clay sculpting supports the exploration of unconventional walkie-talkie forms beyond existing design norms.
2. To examine how subject matter inspiration guides students' form development through clay modeling.
3. To evaluate how incorporating clay sculpting influences students' overall design process, particularly in relation to repetitive refinement, hands-on engagement, and creative problem-solving.

2. Literature Review

Ideation Strategies in Design Education

Ideation is an important part of the design process because it allows students to generate, explore, and refine ideas before arriving at a final design outcome (Daly et al., 2012). It serves as a bridge between conceptual imagination and material realization by encouraging creative thinking, problem-solving, and repetitive learning. In conventional design education, ideation typically depends on visual methods such as sketching, brainstorming, and computer-aided design (CAD). While these approaches are fundamental for communication, they often rely heavily on representational skills and abstract reasoning, which can be challenging for novice students who are still developing their form awareness and visualization ability (Conradie et al., 2015). Consequently, students who struggle with drawing or digital modeling may find it difficult to express complex ideas or explore unconventional forms. This limitation often leads to a narrow range of solutions and the tendency to reproduce familiar patterns or shapes, known as design fixation (Cardoso & Badke-Schaub, 2011; Viswanathan & Linsey, 2012). For early-stage learners, this fixation is intensified by the absence of alternative ideation modes that allow more intuitive, hands-on experimentation. Visual-only ideation restricts opportunities for students to explore proportion, curvature, and spatial relationships in ways that encourage original thinking.

To address these challenges, design educators have begun adopting alternative ideation strategies that integrate physical interaction, sensory feedback, and experiential learning (Parisi et al., 2017). Such approaches support "*thinking through making*," where hands-on engagement acts as a driver for conceptual discovery (Ramduny-Ellis et al., 2010). This perspective emphasizes that ideation is not purely cognitive but emerges from cycles of material interaction, reflection, and adjustment. Moreover, physical ideation strategies such as prototyping, model-making, and material manipulation have been shown to enhance creativity by allowing students to experiment with form, proportion, and structure in real space (Das & Das, 2019).

Engaging with materials encourages active participation and tactile exploration, helping learners better understand texture, volume, and balance, qualities that cannot be fully experienced through digital or two-dimensional methods. Tactile ideation is especially significant for beginners because it externalizes thinking, reduces dependence on sketching proficiency, and supports more intuitive problem framing and form discovery (Lyche & Øverjordet, 2021). Furthermore,

tangible ideation enhances physical cognition, where creative understanding emerges from the sensory and motor interaction between the body and materials (Gomes et al., 2022). When students use materials like clay, foam, or cardboard, they engage multiple senses simultaneously, which supports deeper learning and increased design confidence. Clay-based exploration has been shown to improve students' comprehension of three-dimensional product features and enhance their ability to visualize ideas in subsequent sketches (Su & Phanhabutr, 2024).

Role of Physical Modeling in Creativity

Physical modeling plays a vital role in enhancing creativity within industrial design education. It allows students to visualize ideas, experiment with form, and develop a tangible relationship with their design concepts. Unlike digital or purely visual ideation, which relies primarily on representation, physical modeling invites students to think through materials, transforming imagination into direct physical experience (Ramduny-Ellis et al., 2010). Through hands-on manipulation, learners can spontaneously evaluate volume, proportion, and curvature, which are essential aspects of creative form development often overlooked in screen-based processes (Charlesworth, 2007). Research in design cognition shows that creativity often arises from the dialogue between hand, material, and mind (Bardt, 2019). This repetitive interaction commonly described as "*conscious making*" which enables students to explore possibilities they might not have considered through drawing alone. Physical resistance, imperfections, and material feedback encourage flexible thinking and spark unexpected design directions, reducing dependence on predefined visual references. When students manipulate physical materials, they engage in continuous cycles of trial, adjustment, and reflection. This feedback loop supports immediate decision-making and teaches learners to respond adaptively to constraints, both of which are important for creative problem-solving (Gürsoy, 2018). Unlike virtual modeling, which can sometimes produce idealized results that mask real-world constraints, physical modeling grounds students in the realities of form and structure. Working directly with materials enhances visual awareness, design intuition, and technical fluency, thereby bridging the gap between abstraction and realization. These hands-on experiences cultivate sensitivity to relationships among form, function, and usability, while attuning students to product qualities such as weight, texture, and balance, ultimately improving both aesthetic judgment and practical understanding (Gomes et al., 2022).

The creative potential of physical modeling can be expanded to social and collaborative dimension. In studio settings, tangible models serve as shared objects for discussion and critique, making the design process more interactive and communicative. When students demonstrate physical objects, they share knowledge that is difficult to show with drawings or words alone (Ruth, 2022). This physical presence encourages feedback, modification, and repetition, which are essential elements for encouraging creativity in design education. By engaging in physical modeling, students can observe the immediate effects of their decisions, enabling them to refine their design thinking through physical experimentation. This hands-on reflection enhances form development and builds confidence to take creative risks. This supports the idea that design innovation often comes from exploring and choosing materials rather than from expected results.

Studies on Clay or Tangible Materials in Design

Clay has long been considered one of the most versatile and straightforward materials for teaching industrial design. Its physical qualities and flexibility make it an ideal medium for form exploration, enabling students to translate abstract ideas into tangible shapes through direct hand manipulation. Clay's simplicity facilitates a natural awareness of proportion, balance, and rhythm which fundamental aspects of form development and aesthetic evaluation (Memikoğlu, Berker & Tolun, 2015). When students mould clay, they are not only shaping an object but also

engaging in a dialogue between their thoughts and the material, as ideas evolve through tactile interaction.

Research across design education consistently highlights the benefits of using clay as a medium for ideation and creative learning. Smithwick and Kirsh (2015) described this process as “*thinking with things*,” emphasizing that sensory engagement generates cognitive links between physical actions and abstract reasoning. Viswanathan and Linsey (2012) argued that physical materials reduce design fixation by encouraging broader form exploration beyond traditional visual cues. From an educational perspective, clay sculpting supports both sensory engagement and reflective learning. Manipulating materials by hand enhances sensory feedback and emotional involvement, allowing students to build stronger connections between their ideas and physical outcomes (Ramduny-Ellis et al., 2010). In early design education, this interaction helps bridge imagination and reality by turning abstract concepts into accessible three-dimensional forms (Charlesworth, 2007).

Clay's flexibility also supports iterative design. Because it can be easily reshaped, students can continually modify their models and receive immediate feedback through touch and observation. This iterative quality is crucial for developing reflective and adaptive design habits. Each manipulation encourages learners to reconsider decisions related to balance, continuity, and visual hierarchy. This ongoing cycle of making, observing, and adjusting strengthens form sensitivity while promoting creative risk-taking (Wong et al., 2019). Furthermore, clay modeling enhances collaborative learning in studio environments. When students present physical models during critiques, they provide a concrete artifact that anchors discussion and feedback. This interaction improves communication skills and enriches collective understanding of form and concept. Tangible models act as “*channels of design thought*,” facilitating comparison, reinterpretation, and shared analysis among peers and instructors (Jalali et al., 2023).

The Relationship Between Tangible Ideation and Concept Development

The relationship between tangible ideation methods, such as clay modeling, and the overall concept development process has been widely emphasized in design research. When students engage in physical prototyping such as sculpting with clay, they experience design as a repetitive and evolving process rather than a linear sequence of steps (Viswanathan et al., 2014). This experience helps them understand that early ideation involves continual exploration, adjustment, and discovery. Unlike traditional sketching or digital modeling, which can sometimes feel structured or restrictive, physical modeling allows students to explore ideas freely, make mistakes, and shift direction as new possibilities emerge. This openness is essential for encouraging creative risk-taking and innovation in early design learning (Gürsoy, 2018). Through clay sculpting, students naturally observe how volume, proportion, and balance influence the character of a design (Memikoğlu, Berker & Tolun, 2015). They start to see that design development is not only about producing a result, but about responding to materials and shaping ideas through physical feedback (Charlesworth, 2007). During sculpting, their ideas often “play back” through their hands, with each movement suggesting new curves, features, or proportions, which are difficult to achieve through drawing alone. This interaction reflects the embodied cognition perspective, where design understanding emerges from sensory and motor engagement rather than purely mental visualization.

Through hands-on interaction, students are encouraged to think three-dimensionally, considering how texture, form, and function relate to one another. This process enhances their ability to visualize and evaluate design quality from multiple perspectives. Physical modeling also builds reflective habits: each modification encourages students to pause, assess, and justify why certain

forms feel balanced or expressive. These reflective behaviors contribute to deeper understanding and more informed decision-making throughout the design process.

Tangible ideation also creates a foundation for more refined concept development. By translating clay explorations into sketches or digital representations, students learn how to articulate and communicate the design logic that emerged during physical making. This physical-to-visual transition is especially important for beginners, as it helps them convert intuitive form manipulations into deliberate, communicable design choices. As students shift between clay and drawing, they refine both their ideas and their reasoning, reinforcing the connection between intuition, material experience, and structured design development.

3. Methodology

This study employed a qualitative studio-based approach to investigate how first-year industrial design students use clay sculpting as an ideation tool for form development. The project was conducted within an introductory design course focusing on three-dimensional form exploration. The study was conducted within a first-year Industrial Design course at Universiti Teknologi MARA (UiTM) Kedah, where students were introduced to product form design through practical ideation activities. The methodology focused on observing students' form-making behaviour and identifying how physical manipulation of clay informed their subsequent sketch development, thereby capturing the progression from physical ideation (clay sculpting) to visual refinement (sketch refinement) and the role of material-based exploration in early form development.

Respondent Selection

The study employed purposive sampling involving 17 first-year students enrolled in the Diploma in Industrial Design Technology (AD134) program at Universiti Teknologi MARA (UiTM) Kedah. All participants were new to the discipline and had not previously been exposed to clay sculpting as a design ideation tool. While the overall group consisted of 17 students, 5 students were selected through purposive sampling to allow in-depth analysis of diverse form outcomes. The selection criteria included: (1) variety in clay sculpting approaches, (2) different levels of abstraction and subject-matter interpretation, and (3) clear progression from physical exploration to sketch refinement. This approach ensured that sampled outputs represented meaningful variations in ideation behavior rather than differences in skill level or execution quality.

Research Process

The project was conducted as part of a course module on Product Form Exploration, which aims at developing early design among first-year industrial design students. The studio assignment required students to design a walkie-talkie with a distinctive and unconventional appearance. Rather than relying solely on sketching, students were encouraged to engage directly with clay sculpting as a medium for ideation. Each phase was designed to address specific objectives related to creativity, abstraction and design development.

The process was divided into three interconnected phases, allowing students to move progressively from exploratory making toward structured design refinement.

1. Phase 1: Clay sculpting for ideation
2. Phase 2: Clay form refining into logical walkie-talkie design.
3. Phase 3: Form refinement & sketch translation

Each phase represented a different mode of cognitive and creative engagement, allowing students to move from hands-on exploration to reflective sketching and conceptual refinement.

Data Analysis

Data were analysed using a qualitative visual analysis framework supported by open coding. Clay models, process photos, and final sketches were examined to identify patterns in form exploration, abstraction behaviour, and transitions from physical to visual ideation. The codes were organised into thematic categories, forming the structure through which the findings were presented. Observational notes taken during studio critiques further triangulated the interpretations. This combination of artefact analysis and observational evidence ensured that conclusions were based on both physical outcomes and documented student reasoning. Such triangulation enhanced the credibility of the findings and clarified how design decisions evolved throughout the project.

Phase 1: Clay Sculpting for Ideation

In this phase 1, students were introduced to the principles of form language, aesthetic proportion, and visual balance. They began by collecting visual references inspired by natural and man-made forms such as shells, insects, leaves, or mechanical components which to use as conceptual images for their walkie-talkie design. Using soft industrial clay, students sculpted a series of exploratory forms by hand, without drawing or pre-planning. This “clay-first” approach encouraged spontaneous form discovery, allowing students to express ideas spontaneously. Emphasis was placed on direct material interaction, enabling students to explore form possibilities without the constraints of predefined outlines or representational accuracy. At this stage, students were encouraged to “think through their hands,” reflecting on the physical feedback provided by the clay during the sculpting process.

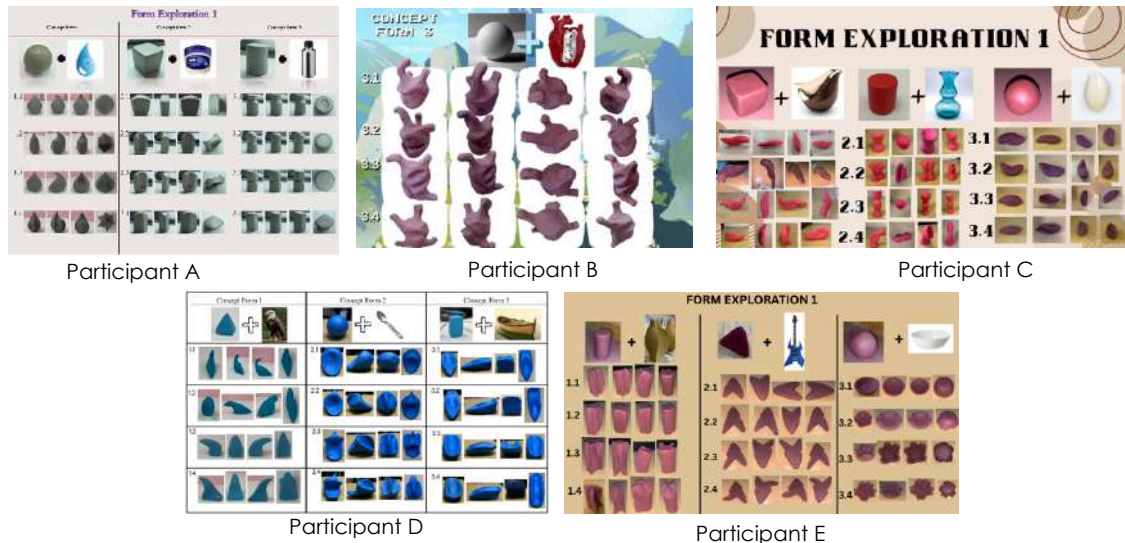


Figure 1. Example of clay sculpting for ideation by Semester 1 Students in Diploma in Industrial Design Technology

Phase 2: Clay Form Refining into logical walkie talkie design.

After evaluating their initial clay explorations, each student selected one promising form for further development. This second phase focused on refining this form into a clearer walkie-talkie concept while retaining the key visual qualities of the original sculpture. Students were required to reinterpret their abstract shapes by incorporating basic functional components such as the screen, buttons, speaker grill, and antenna. During this refinement stage, students were encouraged to preserve the overall rhythm, proportion, and character, while ensuring that the design accommodated ergonomic and usability needs. The aim was to maintain a balance between aesthetic expression and functional clarity which required careful decision-making about how design features could be incorporated without disrupting the clay flow of the form. Students therefore were required to analyze how the product would be held, operated, and visually perceived by applying ergonomic and compositional principles to refine transitions between functional zones. The clay material allowed them to easily add or remove details, test surface continuity, and evaluate the visual hierarchy of design components through direct manipulation. As students refined their forms, they observed how early expressive forms could be adapted into more logical product configurations. The physical nature of clay made this process highly interactive, as each adjustment enabled clearer evaluations of balance, usability, and the overall consistency of the design.

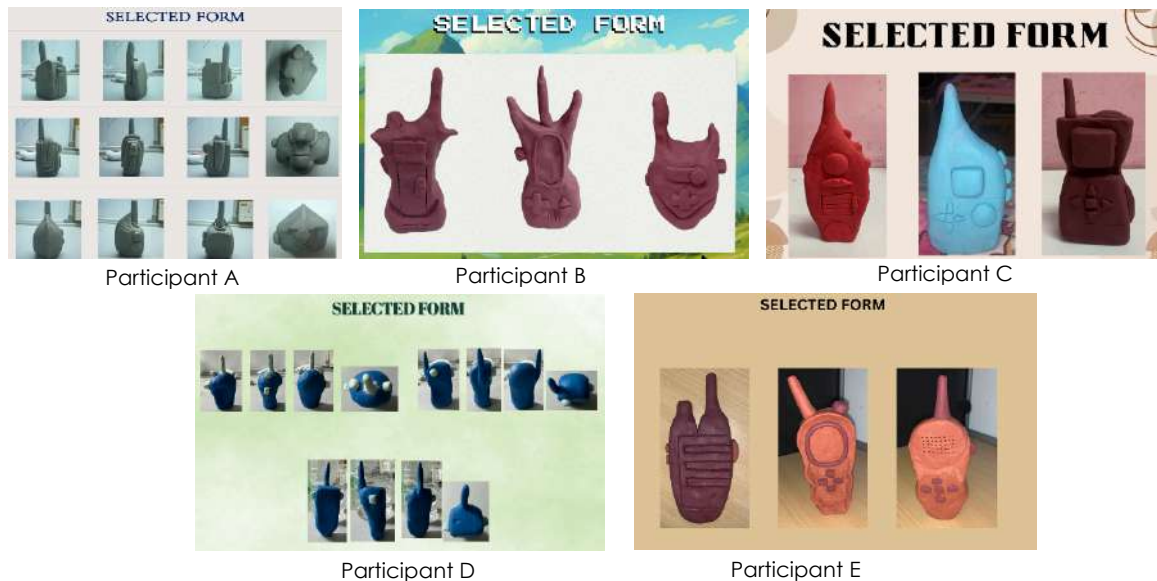


Figure 2. Example of clay form refining into logical walkie talkie design by Semester 1 Students in Diploma in Industrial Design Technology

By the end of this phase, students produced refined clay models that represented a transition from open-ended ideation to purposeful product form development. These outcomes formed the basis for the next phase, where the refined clay forms would be visually translated into detailed sketches for further analysis and presentation.

Phase 3: Form Refinement & Sketch Translation

In the final phase, students transitioned from physical clay modelling to visual refinement and sketch translation. Based on their refined clay models, each student produced a series of sketches to communicate the final form as a design concept. The goal of this phase was to

translate the three-dimensional understanding gained through physical exploration into detailed visual representation, allowing students to analyze and refine their ideas through drawing. Students began by observing their clay models from multiple angles to identify the most effective viewpoints for capturing the product's proportion, silhouette, and interface layout. Using these observations, they developed orthographic and perspective sketches, highlighting key design details such as surface curvature, component integration, and ergonomic handling. Throughout this process, students focused on maintaining continuity of form, ensuring that the visual language of the sketches reflected the physical fundamental of the clay model while achieving higher design clarity.

Students also re-evaluated earlier design choices by comparing physical forms and drawings with the corresponding sketches to ensure that functional considerations, such as button placement, handle comfort, and display visibility, aligned with both usability and the intended formal language. Through sketching, they learnt how to integrate creative expression with practical design logic, transforming abstract clay shapes into visually coherent and functionally meaningful product concepts.

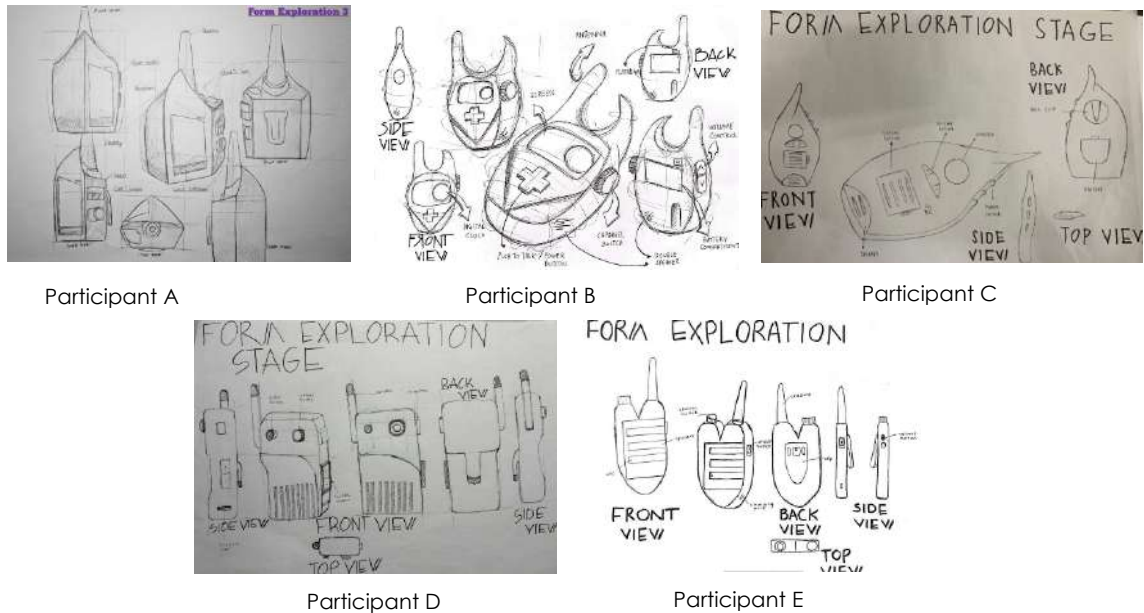


Figure 3. Example of Form Refinement & Sketch Translation by Semester 1 Students in Diploma in Industrial Design Technology

Redrawing their clay models encouraged students to critically consider proportion, usability, and composition, which helped them understand the connection between their material understanding and visual representation. By the end of Phase 3, students had completed a consistent physical to visual ideation cycle, progressing from clay exploration to refined sketch visualization. This process significantly improved their technical drawing skills, design reasoning, and self-reflective ability. It also illustrated how physical ideation can effectively support visual development in early design education.

4. Discussion and Findings

The findings are presented according to three themes identified during the coding process: (1) exploration of unconventional forms through clay sculpting, (2) translation of subject-matter inspiration into structured form language, and (3) influence of physical modeling on students' design reasoning and sketch refinement. These themes reflect consistent behavioural patterns observed across the selected participants and demonstrate how clay sculpting supported creative ideation beyond descriptive outcomes. They also align directly with the study's aim of understanding how physical ideation contributes to form development among beginner industrial design students.

Exploration of Unconventional Walkie-Talkie Forms

Traditionally, walkie-talkie designs are standardized, characterized by rectangular profiles, symmetrical structures, and functional but predictable layouts. To challenge these conventions, students were encouraged to draw form inspiration from natural, organic, or everyday sources such as shells, insects, leaves, or mechanical components. This strategy aimed to disrupt habitual thinking and encourage varied form exploration, a main indicator of creative ideation in early design education. Through physical engagement with clay, students were able to reinterpret these inspiration sources into abstract yet recognizable product forms. Since there were no pre-made templates, they could think through touch instead of fixed visual ideas. The malleable nature of clay encouraged continuous adjustment, leading to spontaneous form discovery and expressive variations. This physical interaction helped students to focus on how a product could feel in the hand rather than simply how it should look.

Participant A, for instance, began with a spherical clay form combined with a water drop shape. However, after experimenting with water drop shape clay form, the final concept evolved into a geometric, water drop inspired walkie-talkie featuring integrated curvature and ergonomically designed hand-grip zones (see Figure 4).



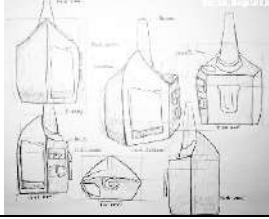


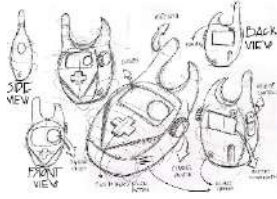


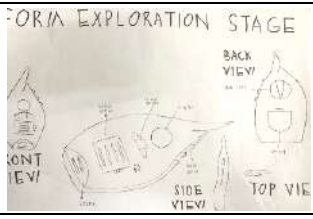


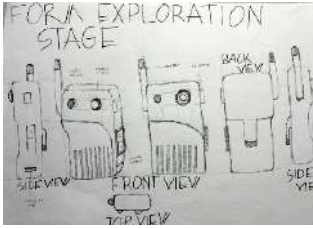


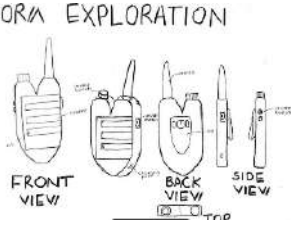


Figure 4. Participant A form development from water drops shape subject matter

The results show that clay modelling allows students explore three-dimensional shapes without being limited by how they usually sketch or come up with ideas digitally. Table 1 below presents a comparison of selected student outputs before and after the clay sculpting phase. It shows how their designs changed in terms of shape, originality, and abstraction. The comparison further

illustrates how physical modelling enabled students to diverge from conventional outlines and produce more expressive form variations.

Table 1. Comparison of Student Clay Form Outputs, After Clay Sculpting Phase and Sketch Translation

Participant	Initial Clay Form Direction	Clay Influenced Form Outcome (After Sculpting)	Sketch Translation	Main Observation
A				Form inspired by a water droplet was maintained, but adjusted vertically in the sketch for better ergonomic grip
B				Spiral layer inspired by the subject matter was refined as a button grouping zone; surface texture was intentionally smoothed in sketch for a cleaner form finish.
C				Leaf-inspired surface and texture cues were retained, particularly in the button zone, showing clear translation of subject inspiration into functional detailing.
D				Reoriented "pebble" form, improving balance and proportion through symmetric abstraction.
E				Guitar shape inspired silhouette was selectively retained and modified to suit functional zones, balancing abstraction and usability.

Integration of Subject Matter as Form Inspiration

Most students successfully extracted design elements such as surface texture, rhythm, or form base from their chosen subject matter. This process helped students visualize forms differently, using inspiration from nature, objects, or animals to define both structure and aesthetic. Translating 2D references into 3D clay studies made the influence of the subject matter more tangible and traceable in their final design. For instance, Participant A's inspiration from a water droplet led to a vertically stretched, organically contoured model that emphasized fluidity and ergonomic grip. Participant C retained the leaf's surface texture and contouring to define both the device's visual identity and the placement of interactive elements such as buttons. These transformations indicate that subject matter served as more than just aesthetic reference it was used strategically to inform proportions, orientation, and the interaction layout of the final product. This demonstrates that students were not merely imitating visual references but actively abstracting and reinterpreting form signs into functional product logic. This process reflects an embodied ideation approach, where understanding of form develops through direct hand manipulation and material feedback.

The integration of subject matter as a source of form inspiration played a significant role in guiding students toward more impactful and meaningful design outcomes. Instead of beginning with conventional geometric templates or existing product archetypes, students were encouraged to reinterpret visual and structural characteristics from chosen reference subjects such as animals, plants, tools, or natural formations and translate them into product form ideas. This process aimed to enhance creative thinking by connecting observation, interpretation, and abstraction, which are essential components of ideation in industrial design education. Through this approach, students learned to view the world around them as a continuous source of design possibilities. The exercise focusses on how to think and look like a designer. It teaches you how to take basic things like form, proportion, and movement from everyday things and turn them into useful product features. For instance, the curvature of a leaf might inspire a gentle ergonomic contour. Such analogical thinking enhances conceptual depth, enabling students to create products that are both functional and visually appealing. The integration of subject matter not only stimulated creativity but also helped students overcome early design fixation. By focusing on conceptual transformation rather than replication, they became more open to experimentation and more confident in generating unique ideas.

Impact of Clay Sculpting on the Design Process

The introduction of clay sculpting as part of the ideation process significantly impacted students' approach and understanding of design development. For many first-year students, this was their first experience working directly with a material that responded immediately to touch. The clay medium encouraged a more exploratory and reflective design process, shifting focus from producing perfect outcomes to learning through experimentation. This physical engagement helped students to visualize and test ideas physically, allowing them to observe form relationships and proportions directly rather than imagining them abstractly. The impact was most visible in the students' ability to translate physical understanding into visual reasoning during the sketching phase. Those who began with clay showed improved confidence in rendering proportions and demonstrated greater sensitivity to form transitions and surface flow. Their sketches exhibited clearer structural logic and more intentional placement of functional features, indicating that physical ideation supported more informed visual decision-making. By first shaping ideas in three dimensions, students developed a sense of form logic that guided their subsequent sketches with both accuracy and expressive clarity.

From an educational perspective, integrating clay sculpting into the design process demonstrated significant advantages in enhancing students' creative confidence and design

reasoning. It changed the culture of the studio from one that focused on getting results to one that focused on learning through the process, where making, observing, and thinking were all equally important. This variation positioned the design process as repetitive rather than linear, reinforcing the value of experimentation at the early stage. This change strengthened the main point of this study that physical ideation is an important part of visual and conceptual development in industrial design education.

5. Conclusion

The findings demonstrated that clay modeling encouraged students to explore unconventional walkie-talkie forms beyond existing commercial designs. By integrating subject matter into their design process, students were able to generate original form directions with strong conceptual meaning. The hands-on nature of clay allowed them to think visually, test proportions, and physically engage with form development in ways that traditional sketching or digital tools could not offer. Moreover, clay sculpting supported exploration, promoted repetitive critical thinking, and align the gap between abstract ideas and tangible outputs, fulfilling all three study objectives. These outcomes indicate that physical ideation plays a crucial role in developing early form sensitivity among beginner design students.

Based on these outcomes, several practical recommendations are proposed for design instructors. Clay sculpting should be introduced as a method to help students move beyond passive visual referencing and encourage active form exploration. Facilitators are encouraged to guide students in using subject matter as a creative stimulus to generate abstract and expressive designs. Sufficient studio time should be given for students to experiment with multiple clay studies before refining their final concept. Physical modeling can also be complemented with sketching and digital visualization to support a balanced ideation process. Feedback discussions or short write-ups should be encouraged to help students to analyze their thinking and decision-making throughout the process. These teaching strategies can strengthen students' understanding of form development and support more intentional ideation behaviours.

While the study provides useful insight, further study is needed to deepen understanding of clay sculpting's pedagogical value. Future studies could compare the effectiveness of clay sculpting with digital ideation tools, or employ structured evaluation methods to assess creativity, originality, and usability. Long-term investigations could explore how hands-on ideation methods influence a student's growth over multiple semesters. Moreover, applying this method across different product categories such as lighting, furniture, or wearable technology may help evaluate its versatility in various design contexts. Finally, cross-disciplinary or collaborative approaches combining clay sculpting with other creative practices may open new opportunities for expanding ideation strategies in design education. This study contributes to industrial design education by demonstrating that clay sculpting functions as both a form-making exercise and a structured ideation method. It enhances creative risk-taking, supports abstraction from subject matter, and strengthens students' ability to transition from physical exploration to sketch-based refinement.

Acknowledgments

The author gratefully acknowledges the Industrial Design Department at the Faculty of Art and Design, UiTM Kedah Branch, for their ongoing support and resources during this study. Thanks also go to colleagues and peers for their help and useful feedback, which greatly

improved this study. Special appreciation goes to the participants and contributors whose insights and expertise were essential to the success of this project.

Authors Contributions

Author is the main writer and researcher in producing this paper.

Conflict of Interest

Author has no conflict of interest in this publication.

References

- Bardt, C. (2019). Material and mind. In *The MIT Press eBooks*. <https://doi.org/10.7551/mitpress/12199.001.0001>
- Cardoso, C., & Badke-Schaub, P. (2011). The influence of different pictorial representations during idea generation. *Journal of Creative Behavior, 45*(2), 130–146.
- Charlesworth, C. E. (2007). Student use of virtual and physical modelling in design development: An experiment in 3D design education. *The Design Journal, 10*(1), 35–45.
- Chugh, D., & Tiwari, V. (2024). Effective ways of teaching form studies as a course to product design students. *ShodhKosh: Journal of Visual and Performing Arts, 5*(ICETDA24), 73–79. <https://doi.org/10.29121/shodhkosh.v5.iICETDA24.2024.1303>
- Conradie, P., Nafzger, R., Vanneste, C., De Marez, L., & Saldien, J. (2015). Methods for ideation: Reviewing early phase concept generation among industrial design engineer students. Presented at the *17th International Conference on Engineering and Product Design Education (EPDE 2015)*, Loughborough, UK.
- Corremans, J. A. M. (2009). Measuring the effectiveness of a design method to generate form alternatives: An experiment performed with freshmen students product development. *Journal of Engineering Design, 22*(4), 259–274. <https://doi.org/10.1080/09544820903312416>
- Daly, S. R., Yilmaz, S., Christian, J. L., Seifert, C. M., & Gonzalez, R. (2012). Design heuristics in engineering concept generation. *Journal of Engineering Education, 101*(4), 601–629.
- Das, S., & Das, A. K. (2019). Tool for teaching physical model making in product design. *IOP Conference Series: Materials Science and Engineering, 686*(1), 012034. <https://doi.org/10.1088/1757-899X/686/1/012034>
- Gomes, M. G., Ogliari, A. J., Fernandes, R. B., & Marques, K. (2022). Evaluation of physical models as creative stimuli in conceptual design of products. *Design Studies, 80*, 101061. <https://doi.org/10.1016/j.destud.2021.101061>
- Gürsoy, B. (2018). From control to uncertainty in 3D printing with clay. In A. Kepczynska-Walczak & S. Bialkowski (Eds.), *Computing for a better tomorrow* (pp. 21–30). Proceedings of the *International Conference on Education and Research in Computer Aided Architectural Design in Europe, Vol. 2*. <https://doi.org/10.52842/conf.eacaade.2018.2.021>

- Hill, S., & Baker, E. W. (2016). An active learning exercise for product design from an operations perspective. *Decision Sciences Journal of Innovative Education*, 14(3), 273–284.
- Jalali, Y., Bürer, M. J., Petringa, N., & Zufferey, J. D. (2023). What role do tangibles play in fostering design thinking skills? An exploratory study. *IEEE Frontiers in Education Conference (FIE)*, 86, 1–9. <https://doi.org/10.1109/fie58773.2023.10343272>
- Jensen, D. (2004). A design methodology for hands-on classroom experiences. In *2004 Annual Conference Proceedings*. <https://doi.org/10.18260/1-2--12990>
- Karni, R., & Shalev, S. (2004). Fostering innovation in conceptual product design through ideation. *Information, Knowledge, Systems Management*, 4(1), 15–33. <https://doi.org/10.3233/IKS-2004-00062>
- Kuhns, A. (2024). *Exercising the Everyday: A Pedagogical Approach*.
- Lu, X. (2024). Using augmented reality for sculpture teaching in art schools. *Membrane Technology*, 222, 222–227. <https://doi.org/10.52710/mt.161>
- Lyche, W., & Øverjordet, P. (2021). New manual and digital exploration in surface textile design: A superuser approach in design education. *DS 110: Proceedings of the 23rd International Conference on Engineering and Product Design Education (EPDE 2021)*. <https://doi.org/10.35199/epde.2021.82>
- Memikoğlu, İ., Berker, O. S., & Tolun, E. (2015). Experience with clay in the basic design education. *Global Journal on Humanities & Social Sciences*, 1(2), 221–226. <http://www.world-education-center.org/index.php/pntsbs>
- Parisi, S., Rognoli, V., & Sonneveld, M. (2017). Material tinkering: An inspirational approach for experiential learning and envisioning in product design education. *The Design Journal*, 20(sup1), S1167–S1184. <https://doi.org/10.1080/14606925.2017.1353059>
- Ramdueny-Ellis, D., Dix, A. J., Evans, M., Hare, J., & Gill, S. (2010). Physicality in design: An exploration. *The Design Journal*, 13(1), 48–76.
- Ruth, D. (2022). Transforming learning through tangible instruction: The case for thinking with things. *Innovations in Education and Teaching International*, 59(4), 495–496. <https://doi.org/10.1080/14703297.2022.2100053>
- Smithwick, D., & Kirsh, D. (2015). Let's get physical: Thinking with things in architectural design. *Proceedings of the Annual Meeting of the Cognitive Science Society*, 37. <https://escholarship.org/uc/item/6d52231n>
- Stevens, J. K. (2024). Access + opportunity = empowerment: Overcoming impostor syndrome through hands-on material exploration. *112th ACSA Annual Meeting Proceedings, Disruptors on the Edge*, 584–591. <https://doi.org/10.35483/acsa.am.112.74>
- Su, H., & Phanhabutr, S. (2024). Innovative product design for clay dogs. *International Journal of Sociologies and Anthropologies Science Reviews*, 4(3), 277–288. <https://doi.org/10.60027/ijasar.2024.4177>

- Urrea, C. C., & Hailey, C. (2023). Designing, making, and the body intuitive. *UF Journal of Undergraduate Research*, 25. <https://doi.org/10.32473/ufjur.25.133478>
- Viswanathan, V., Esposito, N., & Linsey, J. (2012). Training tomorrow's designers: A study on the design fixation. *ASEE Annual Conference & Exposition Proceedings*.
- Viswanathan, V. K., & Linsey, J. S. (2012). Physical models and design thinking: A study of functionality, novelty and variety of ideas. *ASME Journal of Mechanical Design*, 134(9), 091004.
- Wong, A. N. T., & Au, W. T. (2019). Effects of tactile experience during clay work creation in improving psychological well-being. *Art Therapy*, 36(4), 192–199. <https://doi.org/10.1080/07421656.2019.1645501>



اَللّٰهُمَّ صَلِّ وَسَلِّمْ وَبَارِكْ عَلَىٰ سَائِرِ الْمُرْسَلِيْنَ
UNIVERSITI
TEKNOLOGI
MARA



eISSN: : 2682-7840