Design Project Classroom: Fostering Industry-Ready Industrial Designers through Academic-Industry Collaboration

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ABSTRACT

As the demands of the job market continue to evolve, it becomes imperative for educational institutions to equip students with the necessary skills and competencies to thrive in their respective industries. This article explores the implementation of a design project classroom as an innovative approach to preparing students for the job market, specifically in industrial design. The research employs the method of participant observation combined with interviews to gain valuable insights from industry professionals and student participants. Collaboration with industries is integral to this research, where it enables students to engage directly with real-world design challenges and obtain expert guidance. By leveraging the expertise and resources of these partnerships, this project aims to bridge the gap between academic knowledge and industry expectations. The results of this study showcase several key elements that students need to master before graduating, identified through feedback from both students and mentoring companies. The findings underscore the significance of hands-on experience, interdisciplinary collaboration, and industry engagement in preparing students for successful careers as industrial designers. The positive feedback received from both students and industry partners affirms the effectiveness of this approach in grooming students and enhancing their readiness for the job market. This article contributes to the literature on design education, and the insights provided serve as a foundation for educators and institutions seeking to enhance their design programmes, ensuring that students are adequately equipped with the skills, knowledge, and practical experience to enter the job market.

Keywords: *industrial design, design project, classroom project, industry collaboration, industry-ready students*

INTRODUCTION

Industrial design is a discipline that encompasses a wide range of skills, including creativity, problem-solving, and technical knowledge (Toner 2011). In today's fast-paced and ever-changing marketplace, designers must be prepared to adapt to new technologies, approaches, and markets to remain competitive. This requirement demands an understanding of their role in aesthetic development and the ability to apply new technologies in every aspect of the design process. Additionally, designers must be willing to explore new markets and get involved in activities that can enhance their business brands (Budiyanto, Maizaitulaidawati and Nor Aiza 2021).

In the realm of design, important aspects of design, such as collaboration and innovation, hold a paramount significance that necessitates the cognitive characteristics of a designer (Camacho and Alexandre 2019). For design students to become market-ready and show competitiveness and progress, this study has added an industrial touch to the classroom settings. This research explores the reflections of industrial design students collaborating with industry partners in a live industrial project. The study aims to see how working with the industry affects student's learning and growth as designers, and how they view the importance of

such collaborations in design education. In this academic-industry activity, this research also looks at how the academic and industry communicate and work together in achieving project goals. The study uses qualitative data gathering methods to collect data on the student's experiences, focusing on their understanding of their role in aesthetic development, their use of new technologies, and their engagement in innovation activities. Also, from the perspective of the industry partners, the data gathering was focused on their few aspects of business focus, such as satisfaction, task-completion pleasure, etc.

Through analysing the research findings, this article also highlights the importance of providing opportunities for students to gain real-world experience and collaborate with industry partners. The study suggests that design students must be prepared to apply new technologies, able to approach new markets and engage in innovation activities to remain competitive, thus making themselves stand out among recruiters. These findings provide valuable insights into the changing nature of industrial design partnering with industries in the live project studio setting, the value it gives and the potential it offers. Most importantly, it highlights the skills and knowledge designers need to succeed in the modern world.

WHY STUDENTS NEED TO COLLABORATE?

Collaborating with industries during study years is crucial for students to gain real-world experience and develop their design skills (Yang, You and Han 2010). A successful industrial designer requires a creative mind, technical skills, business understanding, problem-solving abilities, and design proficiency (*Designer Daily* 2020). Creativity drives innovation and helps students meet client demands. Collaborating with industries enhances students' creativity and problem-solving skills by exposing them to real-world challenges and different perspectives (Hsiao, Wang and Chen 2017; Toner 2011; Velu 2023). It also fosters a client-oriented mindset, a critical aspect of industrial design (Camacho and Alexandre 2019).

DEVELOPING THE RESEARCH: THE PROJECT AIMS

Upon developing the project, this study reviewed a few collaboration factors and frameworks to determine the best model for collaboration. In the bigger picture, the researcher has studied Awasthy et al. (2020) framework, which develops an outline to improve the partnership between academia and industries. Also, this study has reviewed Ćudić, Alešnik and Hazemali (2022) examination on factors that impact the collaboration between these two parties. This research then came to an exciting point where it can relate these two significant points in collaboration literature, concluding in the collaboration model between academia and industries written by Salleh and Omar (2013, 5). In their model, it highlights various factors that are crucial for successful collaboration between academia and industries. Two significant factors explored in the research are engagement mode and academician motivation.

Engagement Mode

Under the engagement mode, the research examines four different methods through which collaboration can be conducted. The first one is knowledge exchange. This method's focus area emphasises sharing knowledge and expertise between academia and industries, which involves exchanging ideas, best practices, and cutting-edge research findings to enhance mutual learning and understanding. Secondly, there is through the research and development (R&D). Within the R&D mode, it aims to develop new products, technologies, or processes by leveraging academic expertise and industrial resources. This method encourages innovation and problem-solving through collaborative research projects. The third method of engagement is the consultation work. Collaboration through consultation involves industry experts seeking advice or guidance from academic professionals, which ranges from seeking specialised knowledge to obtaining feedback on design concepts, market analysis, or technical feasibility. Finally, the fourth method of engagement is product commercialisation. This approach centres around converting research outcomes or innovative ideas into marketable products or services. This practice or mode is exciting as it will give a new perspective for students in approaching tasks in studio classes assignments by involving industry partners taking the lead in developing and commercialising products based on the research conducted in collaboration with them.

The research has taken time to draw out the visual literature about this collaboration mode by also taking points from other literature such as Camacho and Alexandre (2019); Awasthy et al. (2020); Ćudić, Alešnik and Hazemali (2022) to get what opportunities the university and industry can offer (see Figure 1).

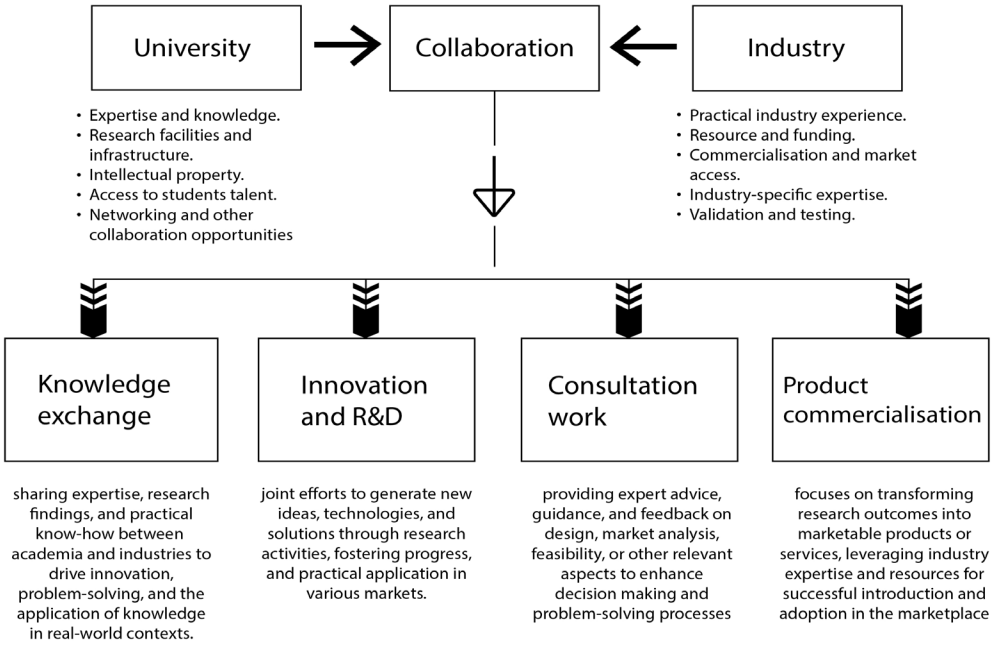

Figure 1 Visualising the literature for university-industry collaboration.
Source: Awasthy et al. 2020; Camacho and Alexandre 2019; Ćudić, Alešnik and Hazemali 2022).

According to Ćudić, Alešnik and Hazemali (2022, 3), universities often provide facilities to conduct research. While some academicians, there are experts in theories and practices in the field, they sometimes work well with industry experts. This study also found that universities may have intellectual property rights to innovative technologies, designs, or inventions that can be leveraged in collaboration with industry partners, thus can help industries to commercialise the products. At the same time, they provide market access during the project. In addition to the literature, industries possess industry-specific knowledge, best practices, and insights into operational challenges (Awasthy et al. 2020, 9). This expertise can guide the development of research projects and ensure their practicality and relevance. This situation can work well with lots of other collaborations with other industries by the university, as discussed by UNESCO institute for statistics, saying that universities have extensive networks that include other academic institutions, research organisations, and industry connections. These networks can facilitate collaborations, knowledge exchange, and partnerships with relevant stakeholders, improving relationships and outcomes between academia and industries (UNESCO 2014, 37).

Academician Motivation

According to the research, academic professionals find it attractive to concentrate on knowledge exchange, R&D, student training, and consultation methods. These approaches align with the academic goals of knowledge dissemination, research advancement, and student development (Ćudić, Alešnik and Hazemali 2022). On the other hand, industries tend to prioritise R&D, consultation, and alternatives to product commercialisation. This focus implies that industries value collaborative research, seeking expert advice, and exploring innovative ways to bring research outcomes to the market beyond traditional product commercialisation.

By understanding the motivations and preferred engagement modes of academia and industries, the research aims to propose a process that accommodates the interests and objectives of both parties. Such a process would foster effective collaboration, encourage innovation, and promote knowledge and technology transfer between the academic and industrial sectors in industrial design.

This study has established a live project spanning one year in collaboration with various industries and businesses to provide students with practical exposure to authentic industry work environments. The industries selected for this initiative represent multiple businesses such as product design, sports items, computer and digital, health, etc.

THE ROLE OF INDUSTRIAL DESIGN: CLASSROOM REFLECTION AND DRAWING THE PROCESS (METHODS)

To begin with, the initial step of the project involved conducting a comprehensive literature review on university-industry collaborations in industrial design. This contextual understanding or literature review step will provide a theoretical framework and insights to support a successful collaboration model and engagement modes, and methods. As discussed in Figure 1, collaboration methods include knowledge exchange, R&D, consultation work, and product commercialisation. The department has partnered through a memorandum of understanding (MoU) with a promotional design product company engaged in a live project with major businesses. This alliance will furnish the company with fresh ideas and concepts through design, while also directing the students in their respective projects.

The execution of the collaboration project follows a well-defined process inspired by the design process outlined in the industrial design literature. The design processes that serve as inspiration include the "double diamond design thinking" (Design Council 2023), "bidirectional process" and "linear process" by Del Giorgio Solfa, Alvarado Wall and Amendolaggine (2021, 9), and "brief to final design" (Sinclair et al. 2011, 4). Generally, the design and thinking process from these three different frameworks has the same agreeable area that is compressed into three primary overlapping phases of design thinking: inspiration, ideation and implementation, as discussed by Rodgers and Winton (2010, 7). This study has concluded and compared theories, course content requirements, and industry needs, as visualised in Figure 2.

After a closer look at the course requirement and the industry's suggestions towards the process, all those suggestive processes did fall into three general categories of design steps. Those categories are inspiration, ideation, and implementation. Figure 2 shows a comparison chart for every party to review and discuss. Figure 3 shows the details for the studio classroom involved, including the course learning outcomes (CLOs), the level and year of study and the course code.

In the project's initial phase, the collaborating industries provided the participating students with comprehensive guidance regarding the essential requirements for working in these sectors. As expected, the standards set by these industries were rigorous, reflecting the actual working conditions prevalent in contemporary business environments. A crucial focus of the project launch discussions was the significance of developing industry-ready skills among the students and fostering personal creativity. Figure 4 shows the design brief used for the project. A more detailed explanation of each activity was given weekly, where the mentors from industries met with the participating students and discussed the progress.

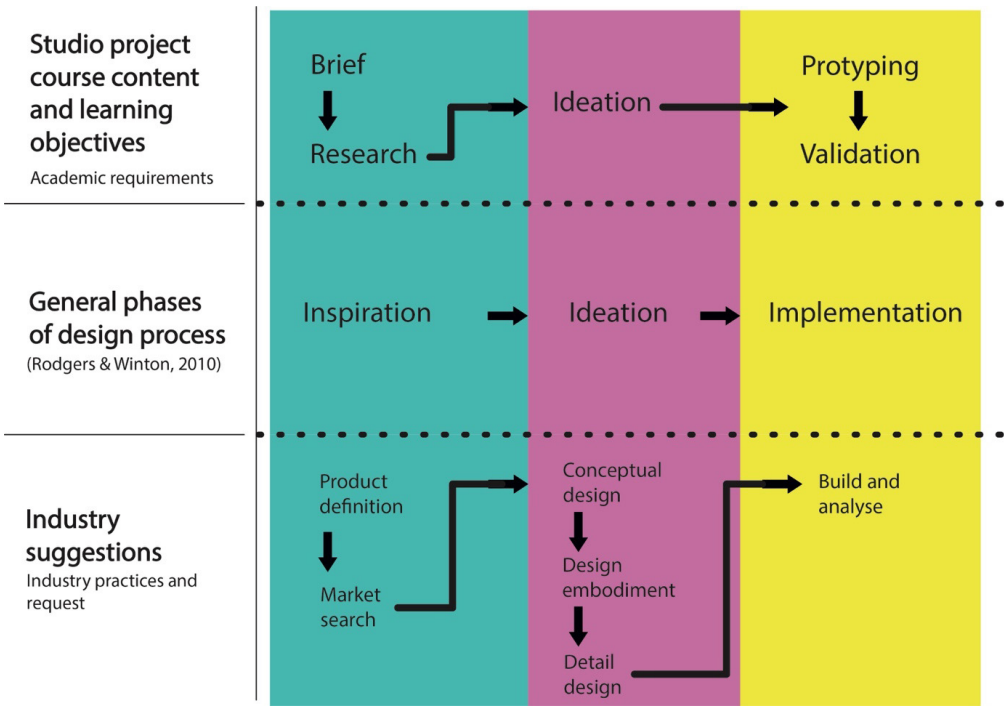

Figure 2 Between literature and project requirement. A reference diagram to develop project phases.

Source: Illustrated by the authors.

1.	Name of Course :	DESIGN STUDIO - COMMERCIAL DESIGN 1				
	Course Code :	ADI24405				
2.	Synopsis :	The course simulates a single project; the Commercial Design practice provides a concentration on the study requiring research, design, and production. Students are assigned to choose their projects according to their researched area. Students will handle design/research problems on an individual level with specific guidance provided. At the end of this course, the student will deliver a high-quality design presentation, complete documentation in written and graphic forms, mockups, 3d visualisation and an extended essay on the market and research of the project.				
4.	Semester and Year offered :	Semester	5	Year	3	
5.	Credit Value :	5				
7.	Course Learning Outcomes (CLO) : At the end of the course the students will be able to:					
	CLO1	Analyze current design issues relating to product design development (C4,MQF2,PLO2)				
	CLO2	Construct solution with design development activities based on the data collection (P4,MQF3a,PLO3)				
	CLO3	Explain commercially viable product idea to the industry and community (A4,MQF4b,PLO10)				

Figure 3 The details for the project classroom involved.

Project Brief

Promotional Design Product

Project Title: Promotional Design Product
Project Duration: 1 Year

Introduction
Promotional design products are items specifically designed to promote a brand or company. These products can range from simple items like pens and keychains to more complex items like branded clothing, bags, and even tech gadgets. The goal of these products is to increase brand recognition and awareness, as well as to create a positive association between the brand and the customer. Promotional design products can be used for various purposes, from corporate giveaways to trade show swag. They can be an effective way to reach a large audience with a relatively small investment.

Figure 1: Example of promotional design item

Project Objective:
The primary objective of this collaborative industrial design project is to provide students with a hands-on, real-world experience by partnering with industry professionals. This project aims to bridge the gap between classroom learning and practical application, offering students an opportunity to design innovative products for selected companies while receiving valuable feedback and guidance from industry experts. Through this collaboration, students will gain insights into the intricacies of product design within a professional setting and develop essential skills for their future careers.

Project Overview: In this project, students will work in teams to design a product that aligns with the needs and goals of a selected company. The project will be divided into several key phases, allowing students to progress through the design process from research and concept development to prototyping and presentation.

Industry Involvement:
Industry partners will actively participate in the project by:

- Providing initial project brief and objectives.
- Offering guidance and feedback during regular meetings with student teams.
- Participating in the final design presentation and evaluation.

Businesses Involved:
Healthcare, Sports, Food and Beverages, Technology and Electronics, Fashion and Apparel, Entertainment and Media, Travel and Tourism, Finance and Banking, Education and EdTech, Agriculture and Agribusiness, Telecommunications, Beauty and Cosmetics, Hospitality, Retail and E-commerce, Energy and Sustainability.

Deliverables *(Industry Requirements)*:

- A comprehensive research report on the selected company and product design context.
- A design concept portfolio including sketches, digital renderings, and design iterations.
- A physical prototype or digital model of the final product.
- A final presentation showcasing the design process and the product concept.

Project Benefits:

1. Students will gain practical experience by working on real-world design challenges.
2. Industry partners will benefit from fresh ideas and innovative design solutions.
3. The project will foster collaboration between academia and industry, enhancing the learning experience for students.

Prepared by:
Centre of Design Studies

Figure 4 Project brief.

This emphasis on industry preparedness and creative capacity aligns with the broader objective of the study to provide students with hands-on exposure to authentic industry work settings. The project aimed to equip students with the skills and knowledge necessary to excel in their future careers by collaborating with diverse industrial design clusters, including product, automotive, and furniture design. Therefore, the discussions held during the project kick-off reinforced the significance of industry-oriented training and cultivating a creative mindset as crucial prerequisites for professional success.

For this collaboration project, 57 students were assigned to different businesses, and the consultation was conducted online. Nearly 15 prominent industries and vendor-related companies were involved in the process. The students have been thoroughly briefed on the project's learning outcomes, as it is an integral part of the existing syllabus in the industrial design studio project. This study observed various approaches given by the industries while tailoring the "detail course information" needs in the syllabus. At the end of the year of this live project, a few reflections were given by the students and their mentors (designers in the industries) towards the requirement needed for students to understand the role of designers. Table 1 displays the business categories, and the research focus the students are tasked to explore. The list of companies has been tabulated, and the participating students have selected the company and research topic they wish to pursue.

Regular communication between universities and industry partners is crucial for the success of this collaboration. It encourages open dialogue and idea exchange, promoting teamwork and innovative solutions that benefit all parties.

Through careful analysis, this study has considered the needs and demands of industry partners to achieve the project's objectives successfully. By utilising the essential criteria and requirements outlined in the CLOs, a comprehensive rubric has been created to evaluate student performance, as shown in Table 2.

The provided rubric is a comprehensive tool for evaluating industrial design students' performance throughout the project duration with industry partners. Throughout the project, lecturers will use the rubric's

Table 1 List of students and the businesses they were assigned to.

Number of students	Industry representatives (by code)	Nature of business (representatives experts)	Focus of research
3	C1	Healthcare	Healthcare delivery, pharmaceuticals, medical devices
5	C2	Sports	Sport businesses, sport medicine, sport attire, sport equipment, fan engagement
4	C3	Food and beverages	Food trends, food safety, restaurant, sustainability
3	C4	Technology and electronics	Consumer electronics, software development, telecommunications
4	C5	Fashion and apparel	Clothing retailers, fashion designers, textile manufacturers, fashion e-commerce
7	C6	Entertainment and media	Film, television, music, gaming, digital media companies, entertainment venues, event organiser
4	C7	Travel and tourism	Airlines, hotels, travel agencies, tour operators
4	C8	Finance and banking	Banks, credit unions, investment firms, fintech start-ups
3	C9	Education and edtech	Schools, universities, online education platforms
4	C10	Agriculture and agribusiness	Farming, agribusiness, food processing, agricultural technology
2	C11	Telecommunications	Mobile, broadband connectivity
3	C12	Beauty and cosmetics	Skincare, makeup, personal care product
3	C13	Hospitality	Restaurants, hotels, event planning services
4	C14	Retail and e-commerce	Retail businesses (physical and online)
4	C15	Energy and sustainability	Renewable energy, clean technology, environmental consulting, sustainable agriculture

Table 2 Rubric assessment.

Assessed Area	Exceptional	Satisfactory	Underdeveloped	Limited
Research and product design analysis	Thoroughly researched and critically analysed literature. Demonstrates deep understanding and relevance.	Conducted comprehensive research and effectively analysed literature, showing a strong understanding.	Limited research and analysis evident; lacks depth in understanding.	No research or analysis evident.
Sketches and ideation (creativity)	Exceptionally creative and innovative sketches. Demonstrates a wide range of ideation techniques.	Creatively generated sketches and ideation with a good variety of concepts.	Limited creativity and ideation; lacks diversity.	No evidence of sketches or ideation.
Design based on market reflection and analysis	Design fully aligns with market research, reflecting an in-depth understanding of target audience and competition.	Design mostly aligns with market research, demonstrating a good understanding of target audience and competition.	Design minimally reflects market research; lacks understanding of target audience and competition.	No evidence of market reflection or analysis.
Mock-ups and testing	Developed highly polished and functional mock-ups. Conducted comprehensive testing with thorough documentation.	Created well-executed mock-ups and conducted testing with clear documentation.	Mock-ups are rudimentary and testing is minimal; documentation is lacking.	No mock-ups or testing evident.
Portfolios and report	Outstanding portfolio and report, showcasing work clearly, concisely, and professionally.	Good portfolio and report, presenting work effectively and professionally.	Portfolio and report are disorganised or poorly presented.	No portfolio or report provided.
Final prototype	Exceptional final prototype that meets or exceeds design goals and requirements.	Proficient final prototype that mostly meets design goals and requirements.	Limited functionality or quality in the final prototype.	No final prototype evident.

well-defined assessment criteria to evaluate students' work at different milestones (see Figure 6), ensuring objectivity and consistency in grading. They will provide constructive feedback based on the rubric's guidelines, helping students recognise their strengths and areas for improvement while tracking their achievement over time.

On the other hand, industry partners engaged in the project will also leverage the rubric to evaluate students' contributions from an industry perspective. They will assess students' ability to collaborate effectively and evaluate the relevance of their research, ideation, and design alignment with real-world market needs. The rubric will guide industry partners in providing targeted feedback to students, helping them align their work more closely with industry standards and expectations.

Drawing the Process and Methods of Industry-Academia Collaboration

To achieve the aim of this project, the department had outlined four stages that must be completed over one year. These stages were drawn out by referring to the three primary overlapping phases of design thinking by Rodgers and Winton (2010), as shown in Figure 5. These stages have been set by both parties of the department and industry partners so that this project will cater to the syllabus's needs academically and support the business project simultaneously.

The process of creating a design involves four stages. The first stage involves establishing the foundation for the project by understanding the market, identifying the target audience, and defining the design problem. The second stage involves conducting market research to analyse market trends, identify customer needs and preferences, and identify opportunities for new products or product improvements. The third stage is solution development, where students will design the product, create mock-ups, and build prototypes. The final stage is the design validation, where students will conduct field-testing, gain feedback, and present their work to the industry partner to ensure that the final product meets the project goals and objectives. The complete chart of this project milestone is shown in Figure 6.

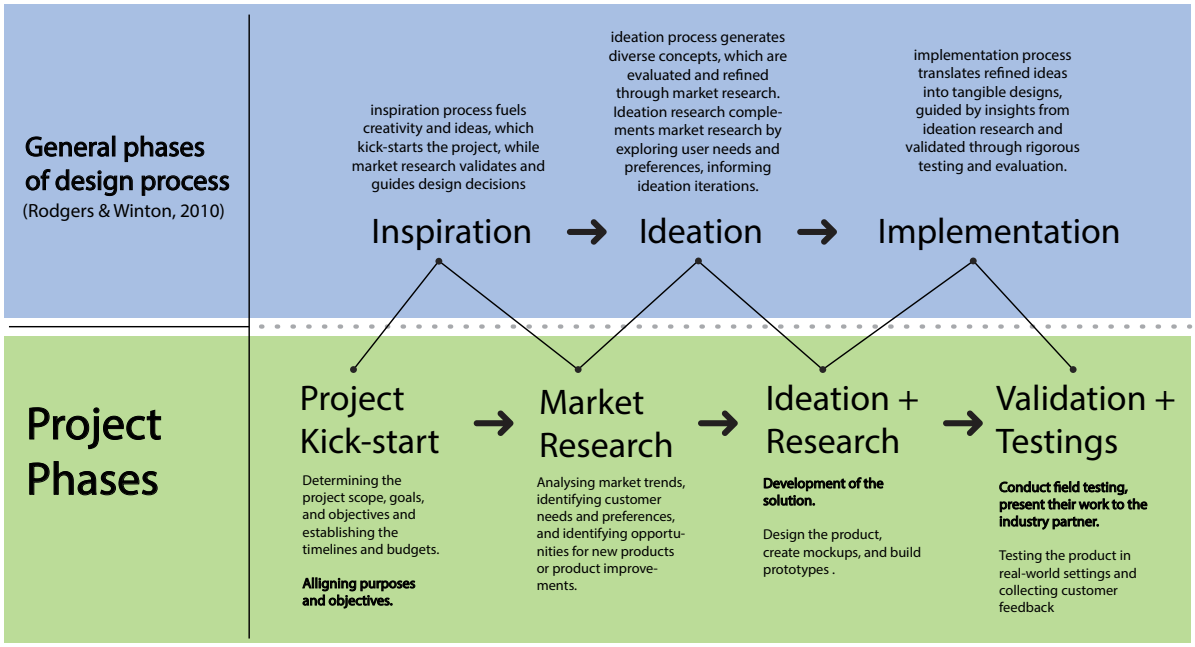

Figure 5 General phases of design process or "overlapping phases of design thinking" by Rodgers and Winton (2010).
Source: Illustrated by the authors.

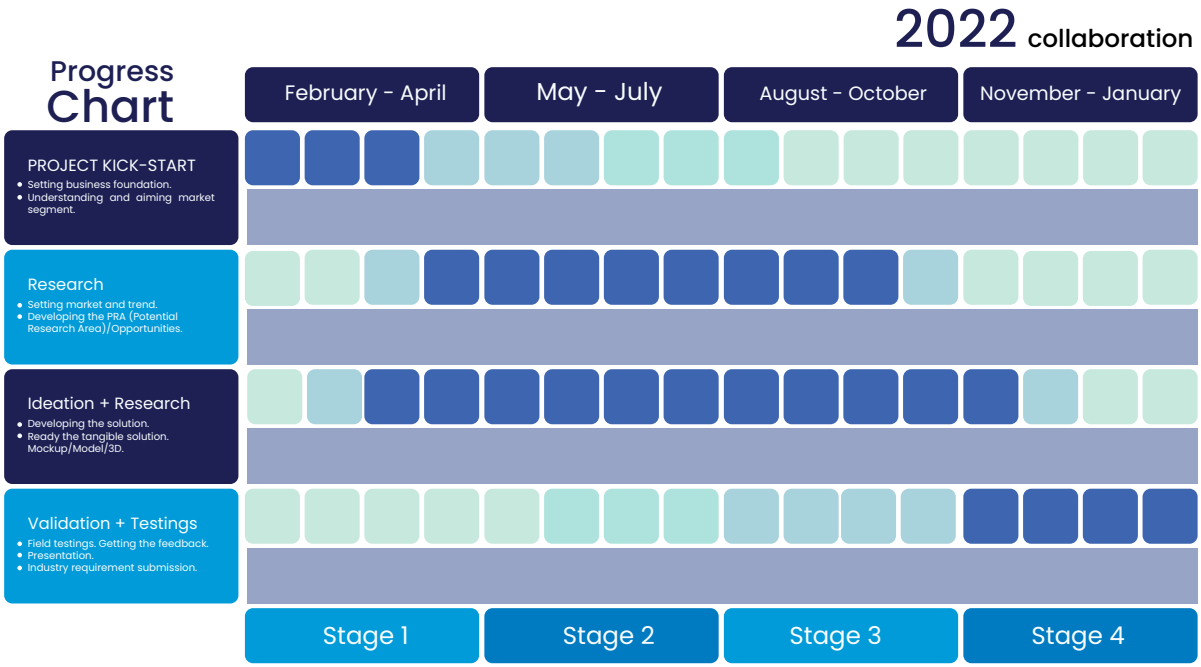

Figure 6 Progress and milestones of the project sets by the academia and industries.
Source: Illustrated by the authors.

This research then conducted several interviews to gain insights and acquire a deeper understanding of the process throughout the stages of the project and to measure the success of the project's outcome. The interviewees from the industry participants are listed in Table 1. For this research, interviews play a crucial role in unravelling the intricacies of collaboration between industrial design students and industry partners within this year-long classroom project. This methodological choice holds significance for several reasons. Interviews offer an avenue to gain in-depth insight into the perceptions and experiences of key stakeholders, including students, lecturers, and industry representatives (Smith, Flowers and Larkin 2009). By employing open-ended questions, this study can delve into the important aspects of the participant's involvement, challenges faced, and lessons learned during the collaborative projects. This qualitative data is instrumental in comprehending the

multifaceted dynamics of the collaboration. Also, interviews allow this research to capture the contextual factors that influence this collaboration, such as curriculum design, institutional support, and industry expectations (Creswell 2007, 18).

Moreover, the iterative nature of interviews enables this study to seek clarification and elaboration on responses, uncovering hidden nuances and unanticipated themes (Erlhoff and Marshall 2008). Also, as collaboration in design education involves multiple stakeholders with unique roles and perspectives, the interviews will provide this research with a comprehensive view by collecting data from students, lecturers, and industry partners separately (Bryman 2012). This triangulation of perspectives enhances the validity and reliability of the findings. Interestingly, the year-long duration of the classroom projects presents the opportunity to explore the collaboration's evolution over time, a task facilitated by conducting interviews at different project milestones (Yin 2003). By using interviews, the study aims to identify best practices, successful strategies, and areas for improvement in the collaboration between students and industry partners, which will inform recommendations for enhancing future classroom projects and curriculum development (Koskinen et al. 2011).

The project was designed to provide students with a comprehensive learning experience encompassing theoretical and practical aspects. To achieve this, the study was conducted in various settings, including classroom-based sessions and real-world scenarios. Throughout the project, designers from the industry and academic instructors closely monitored students' progress and provided valuable feedback on their performance. These observations were critical in helping students develop a deep understanding of the concepts and principles being taught and gain practical experience in applying them in real-world settings. The project's multi-faceted approach proved to be highly effective in enhancing student's learning outcomes and preparing them for successful careers in their respective fields.

OUTCOME OF THE ACTIVITY: SKILLS TO CONSIDER AS DESIGNER

To conclude, the participant of this project comprehends that these future industrial designers require a thorough understanding of aesthetic and technical development, the utilisation of new technologies in the design process, the ability to create new markets for products, and the knowledge to enhance product branding. These identified areas are crucial for students to succeed in the industry, as they must be capable of designing aesthetically pleasing products that incorporate new technologies and can create a new market for the product. Additionally, they need the skills to enhance the product branding to make it more appealing to potential consumers.

Aesthetic and Technical Development

The success of products is attributed to the combination of effective technical design and creative industrial design, as discussed by Ashby and Johnson (2003, 25), which together form the character of a product. As shown in Figure 7, the requirements pyramid is a useful theory to reflect on students' understanding when developing aesthetic-pleasing design and their role during the process. Then, naturally, it will bring about the aesthetic of the design by satisfying all the said requirements. The character of a product is determined by how materials and processes are utilised to provide functionality, usability, and satisfaction to the user. A user's satisfaction is primarily influenced by the aesthetics, associations, and perceptions associated with the product, which we call the product's personality. The overall character of a product is a blend of its functionality, usability, and personality.

During the interview, C5 suggests how a person can be described as an industrial designer. This statement is to have a mindset planted into the mind of every student that some aspects are very critical rather than just focusing on aesthetics; C5 explains that:

> While good design is effective, excellent design also offers enjoyment, which comes from factors such as form, colour, texture, and associations evoked by design. A pleasing design should be honest and convey something about itself, as true statements are typically more satisfying than deceitful ones, although quirky or humorous designs can also be attractive. People who focus on these engineering aspects are called industrial designers.

During the whole duration of the project, these requirements were emphasised heavily in every process of researching and designing. The aesthetic and technical requirements applied during the project proven to be complemented the requirement pyramids as described by Ashby and Johnson (2003) (see Figure7). Sometimes

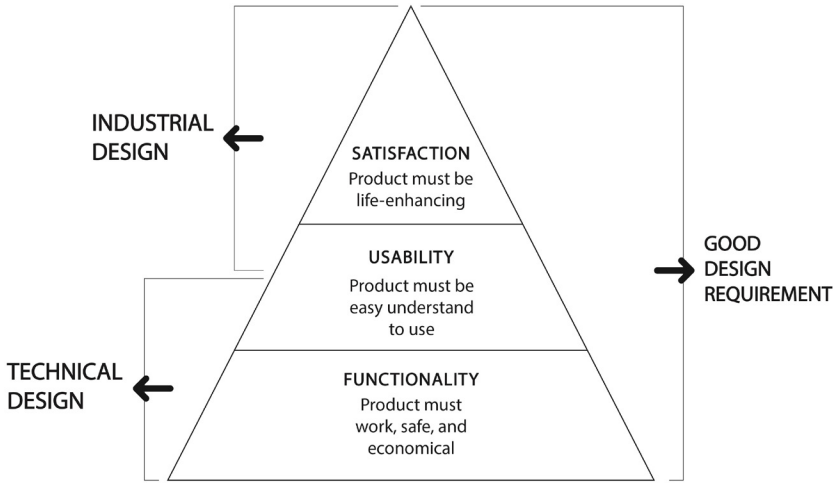

Figure 7 The requirements pyramid.
Source: Ashby and Johnson (2003).

the students were told to check with the technical teams whenever they were about to proceed to the next stage to ensure that their ideas were productionable and met all the technical requirements. Participants were also encouraged to inquire about production constraints to stay informed about the production's capabilities.

Industrial designers aim to create aesthetically pleasing products that are functional and serve a specific purpose. They must consider usability, ergonomics, materials, manufacturing methods, and environmental impact to create unique and innovative products that stand out from competitors and increase businesses' market share and revenue. When reflecting on Ashby and Johnson's (2003) requirements pyramid, C2 agrees by saying that:

> The job of an industrial designer involves much more than just creating something that looks good. It requires a deep understanding of user needs, manufacturing processes, sustainability considerations, and a creative and innovative approach to design.

New Technology Application

At the beginning of the project, some companies had emphasised the importance of technology in driving their business. Some businesses extensively use 3D printing for mock-ups, applying user experience (UX) and user interface (UI) in most design aspects, advertising, etc. The students need to know that, as the world enters IR4.0, most industries, including the creative industries, have moved towards digitalising businesses (Escaith 2022, 8). In supporting the statement, one of the representatives from companies, C2 stated that:

> Industrial designers play a crucial role in incorporating new technology into products by staying up-to-date with the latest updates in various aspects such as materials, manufacturing processes, digital advancements etc. To do this, they must constantly research and learn about emerging technologies, such as things that are in trend in the design field today, for instance, 3D printing, virtual reality, and artificial intelligence, and understand how these technologies can be integrated into the products they design.

Undoubtedly, some students are overwhelmed by new applications of technologies embedded by their attached companies in the design stages. However, the mentoring focuses to remind the students that while technologies offer variety in the outcome, designers should focus on using the tools to add value to the product they have creatively designed. As C6 explained concerning this matter:

> One of the key considerations for industrial designers when incorporating new technology into products is how it can enhance the product's functionality and user experience. For example, designers may incorporate sensors or intelligent technology into a product to make it more interactive and user-friendly, such as by including features like touchscreens, voice control, or motion sensors, which can make the product more intuitive and easier to use.

During the duration of the activities, it is significant for students to know how new technology can improve the development process, and they experienced that the application of technology makes the process more efficient and cost-effective. For instance, 3D printing can enable them to create complex shapes and geometries that would be difficult or nearly impossible to produce using traditional prototyping processes. 3D printing can shorten the process, lower cost, reduce waste and improve the quality of the product-tested mock-ups, making it more reliable to be tested during the design development process before it goes to the manufacturing steps.

Expanding and Creating New Markets from New Product Development

Creating novel products can serve as a strategy to reach new markets, expand market presence, boost sales, and diversify revenue streams. On the other hand, new product development can also be innovative, with cost savings, enhanced profit margins, and increased profitability. Industrial design is a critical business function that is pivotal in identifying new markets and creating demand for existing products. As C8 explain concerning this matter:

> Through thorough market research, industrial designers can pinpoint gaps in the market or unmet consumer needs, allowing them to develop products that address and meet these needs. Additionally, industrial designers can help businesses expand into new markets by designing culturally sensitive products that cater to specific regional or demographic preferences. Thus, incorporating industrial design into a company's overall business strategy can increase profitability and sustain success in today's ever-changing marketplace.

Industrial design involves various activities that enhance a product's functional and aesthetic aspects. Among the activities is that designers will also need to have the ability to identify new markets or create demand for existing products. In achieving this specific business goal, industrial designers conduct extensive market research to identify gaps in the market, areas where consumer needs are not adequately met, or a potential market for product expansion. Through this process, they gain insights into consumer preferences, lifestyle trends, and emerging technologies, which help to inform the design of new products.

After getting aware of the significance of the need to do extensive market research to identify new markets, the students were told to get primary market data and present the analyses creatively. The data presentation was assessed based on various factors that mount as creative data analyses, such as the novelty and originality of the findings, uniqueness of visual elements, creative storytelling, ability to gain interdisciplinary insights, and some of the students managed to conduct experimental approaches where they gain preliminary ideas on design, during the early research stage. The insights from market research are then used to guide the design process as the team develops products that address the identified gaps or unmet needs. In doing so, students and their mentors focus on creating products that meet functional requirements and offer a unique and engaging user experience. This approach is crucial, as it helps to differentiate products in a crowded marketplace and makes them more attractive to potential customers.

Activities that Enhance Brands

One of the experiences that the students gain during the activity is the process of enriching the company's brand. It is evident that industrial designers play a crucial role in establishing and maintaining brand identity within businesses, especially in today's ever-evolving and competitive market. The participating students in this project have been taught to recognise their importance in this growing and challenging business environment. In supporting this, Roberts and Alpert (2010, 4) stated that industrial designers must ensure that a product's design and marketing strategy aligns with the company's branding and effectively communicates its core values and vision. C8 elaborated more by summarising this activity by saying, "Moreover, designers should strive to create products that stand out and are distinguishable from their rivals. Also, they are responsible for aiding businesses in safeguarding their brand by creating unique designs."

Some students get the experience of working directly with the company's branding team to ensure that a product they had designed aligns with the company's overall branding strategy. When creating product designs, they learned to consider various factors that drive the market, such as the product's function, target market, and branding guidelines. By practising this, these future industrial designers can create products that effectively communicate a company's brand values and help establish and maintain a consistent brand identity.

This study has identified two main activities designers do indirectly or should do to help their business expand while protecting their brand. They are (1) differentiation and competitive advantage of design model and processes, and (2) protection of intellectual property.

Differentiation and competitive advantage of design model and processes

Standing out from the crowd is crucial in a highly competitive business environment. Industrial designers can help businesses differentiate themselves from their competitors by creating products with unique designs that appeal to their target market. A product's design can make sense of uniqueness and help a company build a loyal customer base. C1 elaborates more on this by adding:

> Industrial designers can create challenging designs to duplicate or counterfeit, giving companies a competitive advantage. For example, incorporating unique design elements, such as specific patterns or textures, into a product's design makes it more challenging for competitors to copy or replicate the product. This process can help businesses protect their brand and maintain their market share.

Protection of intellectual property

Businesses must prioritise the protection of their intellectual property, and industrial design serves as a crucial factor in achieving this goal. During the activities, students at some companies worked on securing their ideas through patents or trademarks, as one of the business standards, to ensure their ownership of the designed product is certain. However, when this practice was tabled out during the progress meeting, where every company, mentor and student sat together, this patent or trademark process depended on the business's budget and nature. Although it is a very good practice, some companies do not have the capital to do the product registration.

UNLOCKING MORE: WHERE SHOULD THEY (DESIGNERS) VENTURE THEIR CREATIVE MINDS?

During this project-based learning, industry partners have consistently emphasised the importance of the sets area for students to consider. Prior to putting pen to paper, it is imperative that students fully comprehend the fundamental principles of design. This situation is primarily centred around fostering a creative mind, a critical skill that must be honed and cultivated throughout their academic journey to prepare for real industry practice. Comparing businesses that participate in the project, a few innovation types are applied to the students, which have their strengths and are beneficial to prepare them for the job market. This study also observed that every step of the process involved a very specific creativity application process.

So, where should the designers look to venture their creative minds? To answer that, this research needs to look at the role of industrial designers in the creative industries. It is undeniable that industrial designers play an essential role in the vocation of innovation. Innovation activities can be attributed to different categories, such as "additive innovation," which involves enhancing product features; "variety innovation," which focuses on product styling and restyling; and "radical innovation," which explores new product capabilities.

"Additive innovation" is one of the designers' general practices, which involves gradually improving existing products' usage. Industrial design is vital in identifying areas for enhancement and developing solutions to enhance functionality, usability, or sustainability. This process may entail a product designer identifying components that require improvement, such as making them more durable, lighter, or energy-efficient. Additive innovation is typically a continuous process involving ongoing improvement over time. Figure 8 shows one example of additive innovation practice led by students under entertainment and media company mentoring. The students improved the current design by giving values by adding a few extra functions and styling.

With additive innovation, "variety innovations" are crucial to the innovation process in contemporary business environments. On the other hand, variety innovation refers to changing a product's visual appearance or styling without altering its functionality, and industrial design is a crucial factor in achieving this. Industrial designers create visually appealing product designs that align with a company's branding, helping to ensure that products stand out and remain consistent with the company's overall image.

When it comes to product design, variety innovation can take different forms. It could involve giving an existing product a fresh look or creating an entirely new design altogether. This strategy aims to keep the

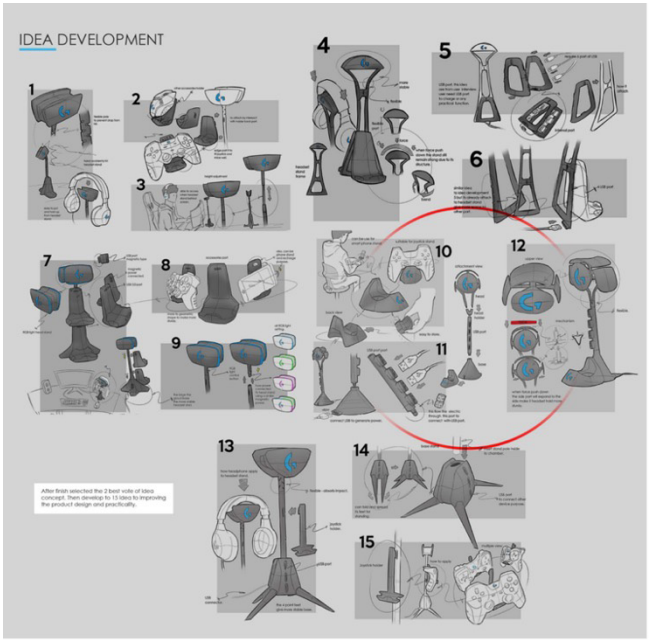

Figure 8 Example of additive innovation of Logitech headset's stand by student participants.
Source: Credit image, Ahmad Aiman Anuar (50595, UniSZA).

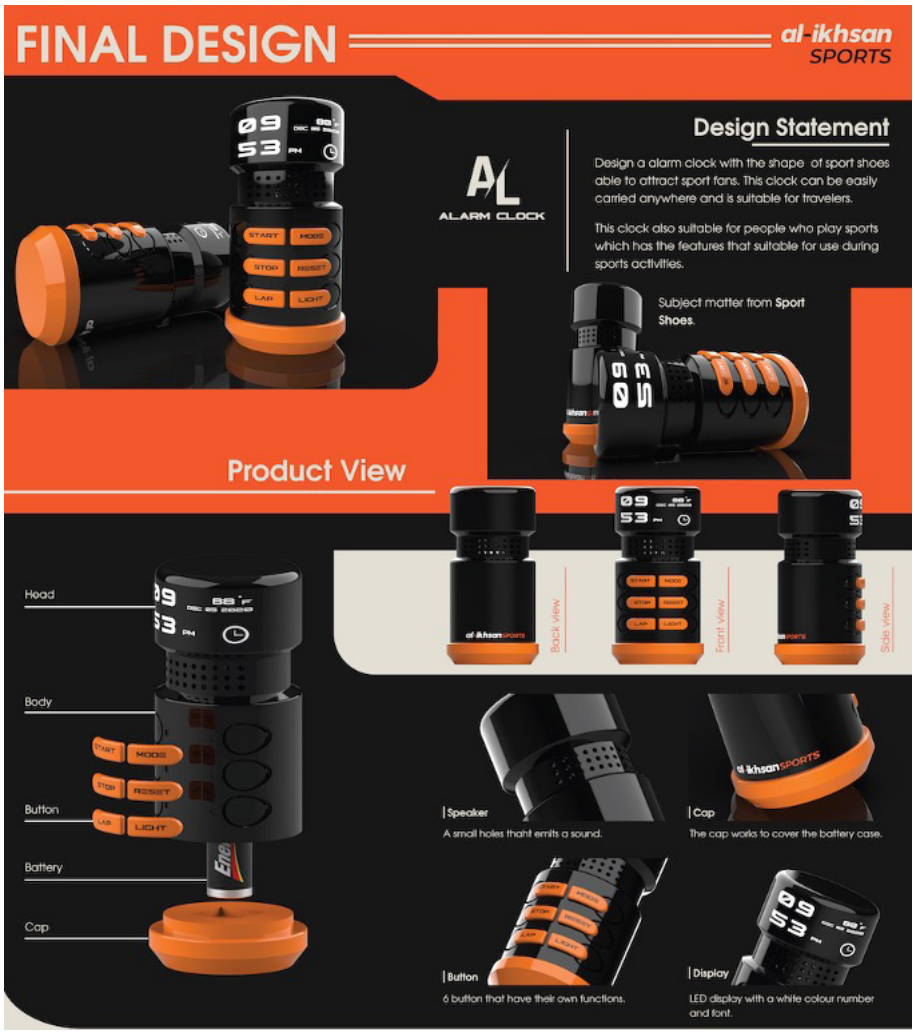

Figure 9 Variety innovation of gifts items representing Al-Ikhsan by student participants.
Source: Credit image, Muhammad Sadid bin Mohd Othman (51240, UniSZA)

Figure 10 Radical design approach for Foodpanda gift items by student participants.

Source: Credit image, Muhammada Adib Zikri bin Shamsulbahri (51280, UniSZA).

product relevant and attractive to consumers, making it a powerful marketing tool. Companies can stay ahead of the curve and remain competitive in the marketplace by constantly updating and improving their products.

Figure 9 shows the initiatives taken by students mentored by sports businesses to venture variety innovation. The mentors identified this product design and its unique process to be closer to variety innovation concepts where the designer applies old ideas to a new method of product usage.

Meanwhile, "radical innovation" involves developing new capabilities or technologies that create new markets. This type of innovation often requires significant risk-taking and can pose significant challenges to established companies that may struggle to adapt to the new technologies or business models. Industrial design can play a crucial role in radical innovation by helping to create new products or technologies that meet the needs of consumers in new and innovative ways. Figure 10 shows the example of a student collaborating with food and beverage businesses to exemplify radical innovation. The aim was to transform the norm of food delivery by developing new must-have packaging to keep the food hygienic while preparing, delivering, and eating.

However, the literature still needs to address the question of organisational devices that can be used to stimulate the emergence of radical innovation capabilities. This situation highlights a significant knowledge gap in the field of innovation. It means that there is a lack of comprehensive guidance or established practices when it comes to using organisational strategies or mechanisms to foster radical innovation within companies. This gap suggests that organisations, including those involved in industrial design practices, may need clear roadmaps for effectively harnessing design as a catalyst for ground-breaking innovation. To address this gap, organisations can encourage interdisciplinary collaboration between teams. This effort can bring together industrial designers, academics, and other experts to collaborate on innovative projects. It will become an opportunity to learn from the experiences of others. By staying open to new ideas and approaches and being willing to adapt based on real-world experimentation, businesses can position themselves as leaders in the ever-evolving landscape of industrial design and innovation.

The collaboration between industrial design students and industries in this project gives students real experience handling design processes. It exposes them to aspects of the design approaches and techniques that are not typically covered in the classroom or syllabus. These include direct discussions with clients, brainstorming with branding departments, budget considerations, and collaboration with technical teams such as engineers and digital content creators to enhance the product experience.

As a result of these experiences, the research identifies four key considerations for students preparing for the job market, as shown in Figure 11. Firstly, students must develop skills in creating aesthetic products suitable for production. This talent involves understanding manufacturing processes and constraints. Secondly,

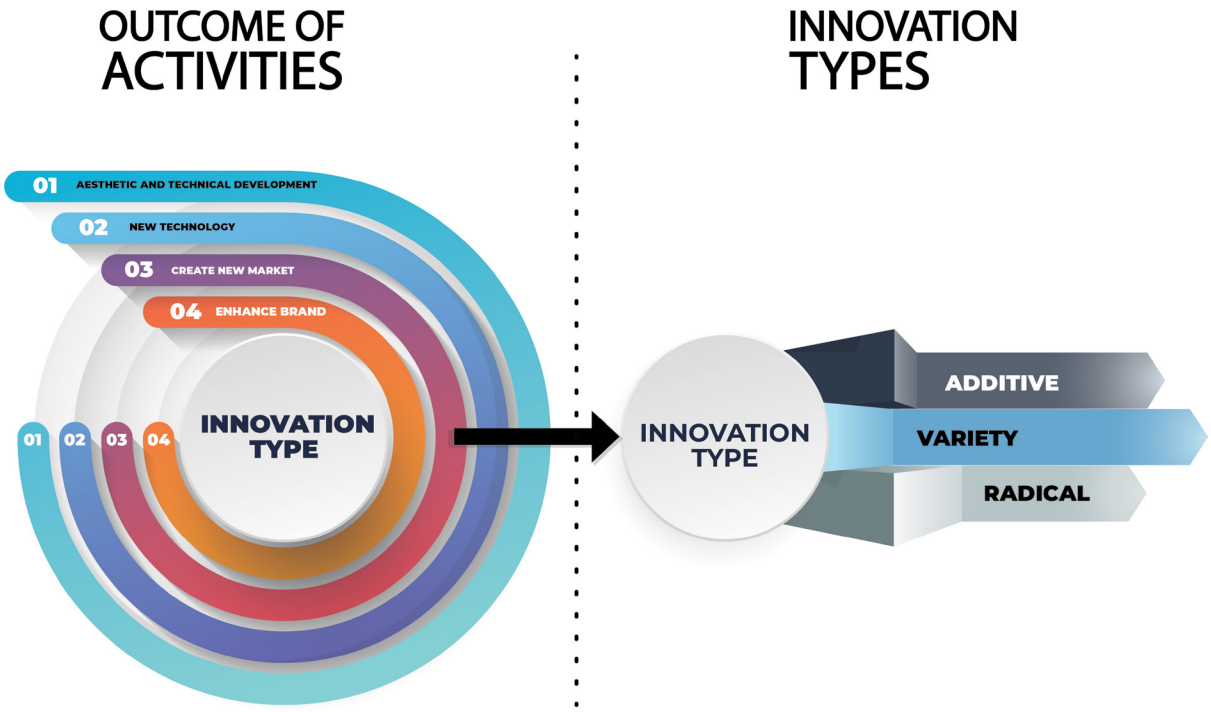

Figure 11 Outcome of activities and innovation types based on the findings.
Source: Illustrated by the authors.

students must be adaptable to new technologies as the design industry rapidly evolves. Keeping up with emerging tools and digital practices enhances their competitiveness. Lastly, students must be able to expand or create new markets for their ideas, requiring an entrepreneurial mindset and the ability to identify untapped opportunities.

Furthermore, the study identifies three unique types of innovation observed in the projects undertaken by different companies. Additive innovation focuses on improving existing products' usage and functionality, ensuring their continued relevance. Variety innovation involves changing a product's visual appearance or styling without altering its functionality, recognising the impact of aesthetics and brand differentiation on consumer perception. Radical innovation centres on developing new capabilities or technologies that create new markets, leading to breakthroughs and reshaping industries. These different types of innovation are important as they drive progress, market competitiveness, and user satisfaction. Additive innovation ensures the continuous improvement of existing products, variety innovation enhances visual appeal and brand differentiation, while radical innovation opens up new opportunities for growth and advancement. Understanding and engaging with these types of innovation provides students with a comprehensive understanding of design approaches and problem-solving in the real-world.

CONCLUSION

Designers use creativity to make artistic and technical innovations. Creativity is an essential ingredient in design with many benefits. It contains elements like diversity and structure, which are split into stages and types, and it's possible to learn different methods. Creativity and innovation are closely linked in UX design; anyone can learn the techniques and approaches involved.

Being creative is essential in the design process and has many advantages. It lets designers develop innovative solutions, empathise with users, and think outside the box. Creativity is closely tied to innovation; producing unique and original ideas is critical. To encourage creativity and innovation, it is essential to provide an environment where risk-taking is encouraged and to provide the resources necessary to promote innovation. Design thinking is a structured, systematic way to solve problems and improve the creative process.

This study explores using a design project classroom to prepare students for the industrial design job market. The study highlights the importance of practical experience, cross-discipline teamwork, and industry involvement for students to excel in their careers. Partnering with industry and incorporating design projects in the classroom is an effective way to prepare students for successful careers in industrial design. The study emphasises the importance of innovation and originality in design and how it benefits both designers and businesses.

However, the study has limitations, including its focus on a specific design project classroom and reliance on participant self-reported data. Future research should investigate the long-term effects of design project classrooms and industry partnerships on students' career progression. Future research should also

Figure 12 Picture of selected items that win prizes during the Promotional Design Award hosted by Majlis Rekabentuk Malaysia (Malaysia Design Council) in June 2022. These products are still under development.

Source: Collection of Centre of Design Studies (CODES), Faculty of Innovative Design and Technology, UniSZA.

compare various models of industry-academia collaboration in design education and evaluate the benefits of industry partnerships for students, educators, and industry partners. A comprehensive assessment of the specific skills and knowledge that students acquire through collaborative projects with industry partners is also warranted. Exploring diverse pedagogical approaches and teaching methods that augment the efficacy of design project classrooms and industry-academia collaborations represents another concept for future research. It is crucial to consider the influence of cultural and contextual factors on the effectiveness of industry-academia collaborations in varying regions or countries. Addressing these areas in future studies can further advance the study's comprehension of the impact and effectiveness of collaborative projects between academia and industries within design education.

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