Terbit *online* pada laman web jurnal : https://jes-tm.org/index.php/jestm/index

Journal of Engineering Science and Technology Management

| ISSN (Online) 2828 -7886 |

JES-TM Journal of Engineering Science & Technology Management

Article

How To Transform a Lecturer's Research Interest into a Student-Centered Learning Class? An Elective Course "Kansei Engineering in Affective Design"

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DOI: 10.31004/jestm.v5i2.337

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ARTICLE INFORMATION

Volume 5 Issue 2
Received: 12 September 2025
Accepted: 29 September 2025
Publish *Online*: 30 September 2025
Online: at https:JESTM.org/

Keywords

Affective Design;
Kansei Engineering;
Project-Based Learning;
Student-Centered Learning

A B S T R A C T

Research-based elective courses can be an alternative to Student-Centered Learning (SCL) classes. Project-based learning (PjBL) can be an attractive learning method. PjBL was developed through lecturers' research interests to balance the tri dharma of higher education. This study aims to give an example of creating an elective course in an SCL class. Kansei Engineering in Affective Design (KEiAD) class is a PjBL elective course successfully implemented in the Industrial Engineering Department of Universitas Trisakti by appointing the lecturer's research. Course learning outcome (CLO) was developed through five major stages of the KEiAD framework: identifying Kansei users, selecting design concepts, identifying key design elements, formulating design, and prototyping. The first lecture had good results. Eleven groups containing two to three students could formulate 11 affective products. All students also succeeded in achieving the expected outcomes of this course. Several students showed interest in using KEiAD as a final project topic. In the future, a quota for elective courses that is too large, such as 32 students, is considered too large because the assistance in class is not intensive enough. Smaller student quotas and R studio alternatives can be considered for continuous improvement.

1. Introduction

The success of learning in class is measured by the fulfillment of Graduate Learning Outcomes (GLO). In Indonesia, where the population is very diverse, various learning methods, such as student-centered learning (SCL), continue to be used and developed. Contained in the National Higher Education Standards (SN-Dikti) regulated in Minister of Education and Culture Regulation Number 3 of 2020, article 14 paragraphs (2) and (3) that the learning process must use effective methods according to the characteristics of the course (Panduan Implementasi Pembelajaran Berpusat Pada Mahasiswa, 2023). Student-centered learning is the learning process that prioritizes developing student creativity, capacity, personality, and needs and developing student independence. SCL also must consider ten aspects: active participation, interaction, real-life skills, higher-order skills, adapting to needs, power-sharing, autonomy, metacognition, formative assessment, and humanistic role (Bremner, 2021b, 2021a; Morris et al., 2023).

Student-centered learning (SCL) can be applied through several learning methods, including project-based Learning (PjBL). During the PjBL, the project results will be presented, and the student's performance will be assessed by achieving the expected knowledge and skills (Berbegal-Mirabent et al., 2017; Guo et al., 2020). Assignments in the form of problem-solving projects related to courses can provide an overview of the real-life skills that students must have after graduating. PjBL has been proven to provide various skills for students and can be applied in the workplace. PjBL can fulfill criteria such as centrality, driving problem, constructive investigations, autonomy, realism, a sense of purpose, psychological safety, community practice, systemic and collective reflection, practice-based knowledge and learning, student support, and balancing didactic instruction with independent inquiry method (Marnewick, 2023). Furthermore, PjBL can be used in the learning curriculum of all departments in Indonesia. Especially for industrial engineering majors, it is possible to implement it, and it is in line with Sustainable Development Goal 4 (SDG 4) and efforts to realize quality education (Fantozzi et al., 2024).

In the industrial engineering curriculum, students must gain design project experience based on previously acquired knowledge and skills (Indonesian Accreditation Board for Engineering Education (IABEE), 2022). This is fulfilled through capstone design courses, but elective courses can be an alternative. In elective courses, lecturers can accompany students more intensively because the number of students in the class tends to be smaller than in mandatory courses. The elective course can help to introduce in-depth instruction to achieve systems integration using appropriate analytical, computational, and experimental practices. The curriculum must provide product and service design experience effectively, efficiently, sustainably, and responsibly. It must also provide real-world experiences that consider human factors (ABET Engineering Accreditation Commision, 2022).

Elective courses can be a specialty of the study program and can be developed based on the lecturer's expertise. Every lecturer must carry out the Tri Dharma of higher education, which requires learning, research, and community engagement. The Lecturer Performance Load (LPL) assessment will account for these three obligations every semester. Research is one of the three dharmas most difficult for lecturers to fulfill. Every lecturer has research interests that will stick with them throughout their career. Through research, lectures can develop and produce quality student graduates who can adapt to the Industrial Revolution 4.0 (Pujotomo et al., 2019). From the student side, study programs must ensure that students understand the concept of lifelong learning before graduating. Students must work independently through lectures, research, experiments, practical training, exercises, and assignments (Indonesian Accreditation Board for Engineering Education (IABEE), 2022). Hopefully, these things can be achieved with the help of elective courses developed from lecturer research.

Curriculum renewal is also needed to enhance student engagement with professional practice through industry case studies and projects. The project will help students train in teamwork, time management, and cultural awareness development activities. The renewal curriculum should focus on creating flexible pathways for student learning (Smith et al., 2024). The successful completion of project-based learning also depends on student perceptions of some factors. They are communication, module planning, student relationships, team structure, strength, and performance; these factors are crucial for an online learning environment (O'Connor et al., 2024). The renewal curriculum was also implemented in the Industrial Engineering department at Universitas Trisakti. Apart from following the BKSTI curriculum, the elective course was developed to facilitate more comprehensive industrial case studies and projects. The elective courses were developed based on lecturer research. One of those courses is "Kansei Engineering in Affective Design (KEiAD)." This course was produced entirely from lecture research, but many things still need to be improved to achieve sustainability.

KEiAD course is a sample where the department gives lectures the freedom to design project units as required. Freedom, co-coordination models, and building a shared understanding of how to interpret student feedback are crucial factors in creating environments in which PjBL can scale in a sustainable way (Miao et al., 2024). Development and evaluation of OBE-based courses must always be carried out so that sustainability can be achieved. This step will provide a course by prioritizing systematic evaluation, giving weight to teamwork, the ideas they contribute, and the way they are presented and defended is essential to obtain the desired objectives in the training process. This strategy is successful in bridging between technology implementation and process instruction (Burguera et al., 2024). Elective courses related to research methods have also been shown to increase students' knowledge and confidence in research skills (Arikan & Milosav, 2024). So far, there have been similar elective courses that have been designed to be integrated with lecturer research in applied linguistics and only focus until the development of the Semester Learning Plan (SLP) (Tajuddin et al., 2024). The absence of research that develops elective courses in the Industrial Engineering department is also the basis for this research. This research does not only provide SLP proposals but also evaluates class implementation and gives strategy recommendations for successful classes. This article aims to provide an overview of how an elective course is created from a research framework, as well as evaluating the implementation of this course.

Although Project-Based Learning (PjBL) has been widely implemented in engineering education, much of the existing literature concentrates on learning outcomes, assessment models, or curriculum alignment. Relatively little attention has been paid to how a lecturer's long-term research trajectory can be systematically translated into a student-centered elective course. Similarly, studies on Kansei Engineering have predominantly addressed its application in product and service design, while its role as a pedagogical framework remains underexplored. This study responds to these gaps by examining the design and implementation of a research-based elective course that embeds the Kansei Engineering process within an Outcome-Based Education (OBE) and PjBL setting. The contribution of this work lies in repositioning Kansei Engineering not only as a design methodology, but also as an instructional framework that connects lecturer research, student-centered learning, and affective design competence development. Accordingly, this study positions elective course design as a strategic interface between research, teaching, and student-centered learning in Industrial Engineering education.

2. Literature Review

2.1 Kansei Engineering in Affective Design

Kansei Engineering (KE), originally introduced by Mitsuo Nagamachi, is a design-oriented methodology developed to capture and integrate users' emotional responses into product and service development. Rather than treating emotion as an abstract or secondary aspect, KE positions affective responses as an explicit design input that informs form, function, and interaction. Emotional impressions emerge through users' visual perception, physical interaction, and experiential engagement with a product or service, and these impressions may vary from basic positive feelings—such as comfort or satisfaction—to more nuanced affective evaluations shaped by context and personal experience. Design outcomes generated through this approach are commonly referred to as affective designs (Nagamachi, 2011).

From the perspective of the Industrial Engineering Body of Knowledge, affective design occupies a cross-disciplinary space between Ergonomics and Human Factors and Product Design and Development. In this context, human emotion is not treated merely as a user preference but as a critical variable that influences usability, acceptance, and overall design quality. Consequently, Kansei Engineering has been widely adopted as a methodological bridge between quantitative analysis and qualitative human experience in design research.

In its applied form, Kansei Engineering follows a sequential analytical process that links emotional perception to tangible design decisions. This process generally begins with the identification of user Kansei, followed by the extraction and selection of representative Kansei words that capture dominant emotional impressions. These affective descriptors are then analyzed to derive underlying design concepts, which are subsequently translated into specific design attributes and formulations. The final stage involves materializing these formulations into prototypes that embody the targeted affective qualities. This workflow aligns with classical Kansei Engineering Type I, while remaining sufficiently flexible to incorporate contemporary analytical tools, including sentiment analysis, multivariate statistics, and data-driven modeling techniques. Through this structured process, emotional responses are systematically transformed into concrete design elements, allowing Kansei Engineering to function as both a research methodology and an instructional approach.

Table 1. Research for the class material essential reference

Authors	Object	Methods	Design Concept
(Hanifati et al., 2024)	Living room design	Term Frequency-Inverse Document Frequence (TF-IDF) Principal Component Analysis (PCA) Quantification Theory Type I (QTT-1)	Harmonious and simple
(Habyba et al., 2023)	Clasroom design	Term Frequency-Inverse Document Frequence (TF-IDF) Principal Component Analysis (PCA) Random tree	Good
(Habyba, Rahmawati, et al., 2021)	Clasroom design	Sentiment analysis Support Vector Machine (SVM)	Comfortable
(Habyba, Djatna, et al., 2021)	E-commerce website	Term Frequency-Inverse Document Frequence (TF-IDF) Principal Component Analysis (PCA) Multidimensional Scalling (MDS)	Sophisticated Affordable
(Rahmawati et al., 2020)	Food delivery order packaging	Principal Component Analysis (PCA) Association Rule Mining (ARM)	Simple
(Habyba et al., 2019)	Jenang packaging	Relief algorithm Association Rules Mining (ARM)	Positive emotion
(Habyba et al., 2018a)	E-commerce website	Term Frequency-Inverse Document Frequence (TF-IDF) Principal Component Analysis (PCA) Quantification Theory Type I (QTT-1)	Natural-Formal
(Habyba et al., 2018b)	E-commerce website	Business Process Modeling Notation (BPMN) Term Frequency-Inverse Document Frequence (TF-IDF) Principal Component Analysis (PCA) Quantification Theory Type I (QTT-1)	Modern

Based on Table 1, Kansei Engineering used to design various products. More than one research was done to support one product design, for example, current research about classroom design. The first research (Miao et al., 2024) focuses on sentiment analysis from the student's preference for the classroom design. For the result we conclude that the students want a comfortable classroom. The continued second research (O’Connor et al., 2024) focuses on developing the classroom design formula with the KE framework. The KE framework is divided into three stages: extracting Kansei words, generating the design concept, identifying the key elements, and formulating the affective design. The elective course “Kansei Engineering in Affective Design” adopts this framework on its expected final capabilities.

3. Research Methodology

This study adopts an educational case study design focusing on course development and implementation within an undergraduate Industrial Engineering program. The case study approach enables an in-depth examination of how a research-based elective course is designed, delivered, and evaluated in a real instructional context, emphasizing learning outcomes, student performance, and continuous improvement mechanisms aligned with OBE principles.

3.1 Time and Place

The Industrial Engineering curriculum adopts the Outcome Base Education (OBE) approach. Where the curriculum is developed based on designing graduate profiles and Program Learning Outcomes (PLO), then how PLO are achieved, and how PLO achievement is guaranteed, as well as a continuous improvement cycle to continue making improvement efforts. More fully, the OBE process is divided into five main steps, namely (1) define learning outcome, (2) define relevant course content, (3) select appropriate rubric to measure student attainment to the outcome, (4) teach and evaluate students and (5) measure process and improvement, these stages repeat continuously (Syeed et al., 2022). OBE implementation provides clear learning outcomes that students must achieve. In achieving learning outcomes, the class will place students as the learning center. This is what we call a Student-Centered Learning (SCL) class. Every student is allowed to be actively involved in the learning process and practice critical thinking in the projects they are working on.

The Kansei Engineering in Affective Design (KEiAD) is an elective course with three Semester Credit Units (SCU). The development of KEiAD as an SCL class follows the KEiAD learning framework (see Fig. 1). The KEiAD learning framework was developed based on OBE process execution at the course level.

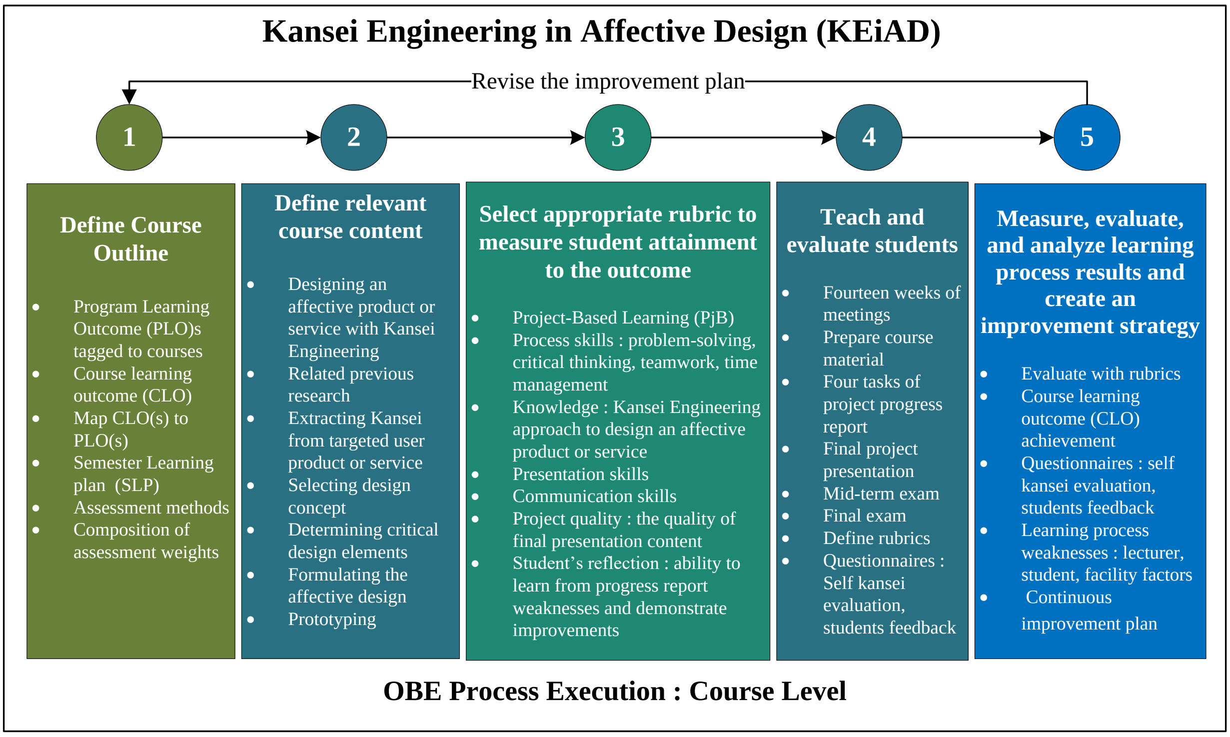

Figure 1. KEiAD learning framework

4. Results and Discussion

4.1 Define Learning Outcome

The first step is to prepare a Semester Learning Plan (SLP). To develop an SLP, the course coordinator must ensure the program learning outcomes (PLO) are charged to the course. There are six PLOs mandated for the KEiAD class to fulfill, namely three attitudes, two general skills, and one particular skill. The absence of PLO knowledge in this lecture does not mean it is ignored; it is not listed explicitly. Students' knowledge develops and is integrated with the skills to apply it to real situations working on this class project. Critical thinking skills, problem-solving, and creativity in PjBL depend on their independence in independent learning. Students can search for relevant information and develop their own understanding as they work on project assignments. The PLO(s) assigned to the KEiAD course are on the list below:

a) Attitude 1 (A1): Students able to show piety, diligence, skilled
b) Attitude 2 (A2): Students able to show a honing, nurturing attitude
c) Attitude 3 (A3): Students able to show chivalry, loyalty, sportsmanship
d) Knowledge 1 (K1): Students able to master knowledge about communication techniques and the latest and most recent technological developments
e) General Skill 1 (GS1): Students able to apply logical, critical, systematic, and innovative thinking in developing or implementing science and technology that pays attention to and applies humanities values by their field of expertise.
f) General Skill 2 (GS2): Students can demonstrate independent performance, make decisions, and be responsible according to the profession and professional ethical aspects.
g) Special Skill 1 (SS1): Students able to do research and investigate complex engineering problems in integrated systems using fundamental engineering principles and conduct research, analysis, data interpretation, and information synthesis to provide solutions.

The Course Learning Outcomes (CLO) was developed based on the essential reference in Table 1. Using the Kansei engineering approach, CLO(s) are created following the affective design stages of products or services. The CLO(s) will fulfill the PLO(s) charged for this course. PLO(s) and CLO(s) mapping can be seen in Table 2 below.

Table 2. Mapping CLO(s) to PLO(s)

Course Learning Outcome (CLO)	**Program Learning Outcome (PLO)**						
	Attitude (A)			**Knowledge (K)**	**General Skills (GS)**		**Special Skills (SS)**
	A1	**A2**	**A3**	**K1**	**GS1**	**GS2**	**SS1**
CLO1: Students can apply Kansei Engineering principles in various affective designs of products/services					√		
CLO2: Students can design the instrument and collect the data from the product or service user well				√			
CLO3: Students can analyze information from data and make decisions using various techniques						√	
CLO4: Students can apply Kansei Engineering in solving problems in product/service affective design research							√
CLO5: Students can demonstrate perseverance and skills in working together in groups to hone their ability to create affective designs	√	√					
CLO6: Students can show the best performance individually in working honestly and are willing to recognize their abilities and those of others			√				

After obtaining the CLO(s) mapped with the PLO(s), the next Semester Learning Plan (SLP) is prepared following the Kansei engineering research framework. There are five main stages: identifying user Kansei, selecting the design concept, identifying relevant design elements, formulating the design, and prototyping. These five stages are divided into 14 weeks of meetings in class, plus two meetings for exams. A detailed description of the framework from the KEiAD class can be seen on Fig. 2.

The initial meeting provides an overview of the Kansei Engineering methodology and important references that students can use as basic references. Apart from that, project groups must be formed at the beginning of college because all assignments will be group-based. Students' abilities will be confirmed through midterm and final exams. At each meeting, a group will make a presentation to provide an update on the progress of their project according to the weekly target. The lecturer only gives examples at the beginning of class and immediately practices with data according to each group's product or service theme. Students must be active in every meeting and discussion in class to try to be as effective as possible in answering problems that occur during project work. An assessment plan must also be available before it is implemented in the SLP. As stated in the SLP, students will be informed of this assessment plan at the start of the course. KEiAD assessment composition can be seen in Table 3.

Table 3 shows the assessment composition for the KEiAD (Kansei Engineering in Affective Design) course. It consists of columns showing Program Learning Outcomes (PLO), Course Learning Outcomes (CLO), assessment criteria divided into Project Report (PR1 to PR5) and Exam (Midterm and Final), and the total assessment percentage. Each row shows how a particular PLO and CLO are assessed through various assessment components. For example, PLO A1 and A2 (both related to attitudes) are assessed through CLO 5 with a weighting of 2% each in the PR5 section of the Project Report. PLO GS2 (General Skills) related to CLO 3 has the highest assessment weighting of 41%, which is obtained from contributions to PR3 (8%), PR4 (8%), Midterm (10%), and Final (15%). The total assessment weighting for all PLOs and CLOs is 100%, which is distributed across the various components of the Project Report and Exam. A total of 70% of the assessment weight in KEiAD elective courses focuses on general and special skills. This supports the development of students' professional skills through elective courses and gives them the opportunity to perform well (Movchan & Zarishniak, 2017).

Table 3. KEiAD assessment composition

Program Learning Outcomes (PLO)		Course Learning Outcome (CLO)	Assessment criteria (%)							Total
			Project Report					Exams		
			PR1	**PR2**	**PR3**	**PR4**	**PR5**	**Mid-term**	**Final**	
Attitude	A1	CLO 5					2			2
	A2	CLO 5					2			2
	A3	CLO 6			2	2		1		5
Knowledge	K1	CLO 2		5				6	10	21
General Skills	GS1	CLO 1	5					8		13
	GS2	CLO 3			8	8		10	15	41
Special Skills	SS1	CLO 4					16			16
	Total		5	5	10	10	20	25	25	100

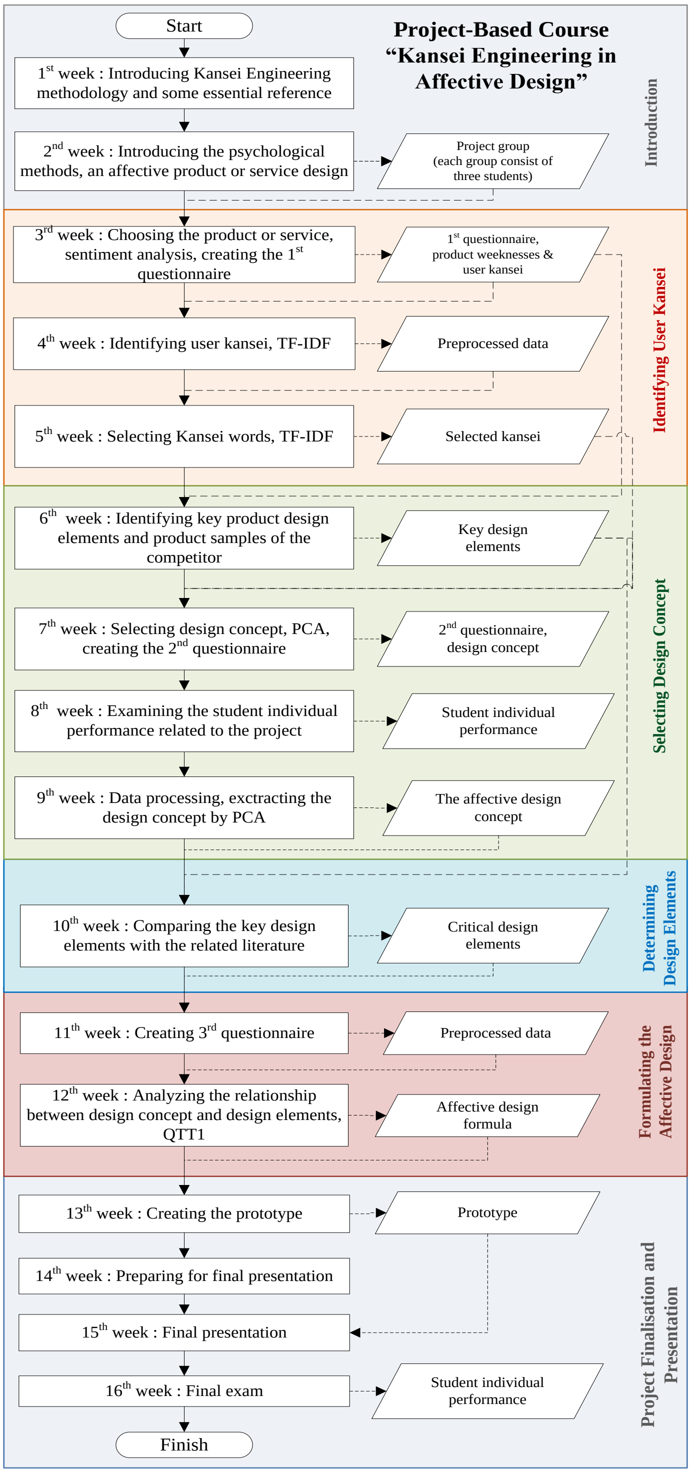

Figure. 2. Framework of KEiAD Project-Based Course

4.2 Define Relevant Course Content

The KEiAD course content follows the Kansei Engineering methodology. There are five crucial steps as follows:

a) Introducing Kansei Engineering Methodology and Psychological Phase

Introduction to what Kansei is, History of Kansei Engineering, Kansei Engineering Type I Method, how to collect Kansei product/service users, Kansei researchers in the world and in Indonesia, related associations, and also core references. In addition, examples of methods for collecting Kansei users through sentiment analysis and questionnaires are also provided.

b) Kansei word extraction

At the stage of data processing, sentiment or questionnaire results will be carried out. Several methods introduced are Support Vector Machine (SVM), Term Frequency-Inverse Document Frequency (TF-IDF), and descriptive statistics. The main focus of this stage is to determine the most dominant Kansei words (KWs) among product/service users. Some of these KWs must be positive and will be considered in determining the design concept. Next, an example of a second questionnaire is given regarding competitor product samples and dominant Kansei words.

c) Selecting the design concept

Concept design selection is carried out to obtain the affective design concept of the product or service. This stage focuses on determining the main and most dominant design concept from the analysis results. The analysis method used is Principal Component Analysis (PCA).

d) Formulating the affective design

This stage focuses on determining the formula of the dominant affective concept design. Each design concept must have a distinctive characteristic. At this stage, it is also very important to identify the right product or service design elements. The more detailed the design elements are used, the easier it will be to find the differences between design concepts. The analysis method used is Quantification Theory Type I (QTT-1). In addition, the Relief algorithm and Association Rules Mining (ARM) can also be used.

e) Creating the prototype

The results of this formula are used as the basis for creating product and service prototypes. The prototype created can be a Minimum Viable Product (MVP). A prototype in the form of a minimum viable product (MVP) is a product or service with a minimal number of features but sufficient to describe the functionality and ease of use to the user (Umbreen et al., 2022). Of course, the MVP that represents the affective design is in accordance with the formula obtained. Students are required to create two MVP designs according to the selected design concept so that they can be compared.

4.3 Select Appropriate Rubric to Measure Student Attainment to the Outcome

The assessment rubric in the KEiAD class is divided into two assessments, namely project reports and exams. In general, the rubric for assessment can be seen in Table 4. The midterm and final exams focus on individual understanding of the overall sequence of using the Kansei engineering methodology in student product re-design projects.

Table 4. Assessment rubric

Assessment	PLO	CLO	Questions	Study material	Achievements			
					Excellent	Good	Enough	Poor
Mid-term exam	GS1	CLO1	1	Kansei Engineering Concept	The explanation and analysis results are in accordance with the questions, are accurate, and are supplemented with literature between 90-100%	The explanation and analysis results are close to correct 70-89%	Only partial explanation given 40-69%	The explanation is only <40%
	GS2	CLO3	2	Kansei Words Extraction				
	GS2	CLO2	3	Concept Design Questionnaire	The student can transform KWs into Semantic Differential scales so that they can be inputted into the next stage of the	The explanation is only accurate between 70-89%	The explanation is only accurate between 40-69%	The explanation is only accurate <40%

Assessment	PLO	CLO	Questions	Study material	Achievements			
					Excellent	Good	Enough	Poor
					questionnaire accurately between 90-100%			
	A3	CLO6	4	Self-Kansei Evaluation	Complete all questions within the time provided	-	-	Not completing the questionnaire
	GS2	CLO 3	1					
	GS2	CLO 2	2	Extracting Affective Concept Design	The concept explanation and analysis results are in accordance with the questions, are accurate, and are supplemented with literature between 90-100%	Concept explanation and analysis results are close to correct 70-89%	Only partial explanation given 40-69%	The explanation is only <40%
Final exam	K1	CLO 3	**3**	Formulating Affective Design	The formula explanation and analysis results are in accordance with the questions and are accurate and are supplemented with literature between 90-100%	Design Formula explanation and analysis results are close to correct 70-89%	Only partial explanation given 40-69%	The explanation is only <40%
	GS2	CLO 3	4		Visualization of score category graphs, explanations, and discussions accompanied by literature 90-100% accurate	Visualization of score category graphs, explanations, and discussions accompanied by accurate literature 70-89%	Only partial explanation given 40-69%	The explanation is only <40%
	A3	CLO 6	5	Self-Kansei Evaluation	Complete all questions within the time provided	-	-	Not completing the questionnaire
	A3	CLO 6	6	Plagiarism Checking	Turnitin test results in 0-15%	Turnitin test results in 16-20%	Turnitin test results in 21-30%	Turnitin test results in > 30%
Project Report	GS1	CLO 1	PR1	Kansei word extraction	The group works synergistically with a clear division of tasks, effective communication, superior time management, significant contributions from all members, proactive problem solving,	The group worked fairly well together with a mostly fulfilled division of tasks and responsibilities, effective communication, good time management, adequate	Group work shows unclear division of tasks and responsibilities, less than smooth communication, less effective time management, minimal contribution from some	Ineffective group work with unclear task division, poor communication, very poor time management, lack of contribution from most members, inability to
	K1	CLO 2	PR2	Design concept selection				
	A3	CLO 6	PR3	Formulating an affective design				
	A3	CLO 6	PR4	Creating prototype				
	A1 A2 SS1	CLO 5 CLO 5 CLO 4	PR5	Project Final Presentation				

Assessment	PLO	CLO	Questions	Study material	Achievements			
					Excellent	Good	Enough	Poor
					and produces high-quality projects of each Kansei Engineering Methodology step.	contributions from most members, and was able to solve most problems well.	members, difficulty in solving problems, and the quality of project results is quite good but shows little synergy.	solve problems, and poor-quality project results.

4.4 Teach and Evaluate Students

The first KEiAD course was implemented in the Odd Semester of the 2023/2024 Academic Year. This elective class was attended by 32 students divided into 11 groups, 10 groups containing three students each and one group containing two students. Each takes on a different product theme. The project results from the 11 existing groups can be seen in Table 5.

Table 5. Summary of student project results

Group	Product or service	Design concept	Group's score	Student's final score
1	Water bottle	Advanced, durable	A-	B, B-, A
2	Muslim cap	Durable, comfortable, modern	A-	B+, A, B+
3	UHT milk packaging	Unique, informative	A-	B, B, A-
4	**Potato chip packaging**	**Satisfying, exclusive, unique, useful**	**A-**	**A, A**
5	Sofa	Comfortable, minimalist	A	A, A, B+
6	Perfume bottle	Modern, innovative, colorful, unique	A-	B, A, B+
7	**Motorcycle Seat**	**Robust, ergonomic, stylish**	**A**	**A, A, A**
8	Watering pot	Good, robust, durable	A-	A-, A, A
9	**Power bank**	**Robust, practical**	**B**	**B+, B+, B+**
10	Electric mop floor cleaner	Comfortable, efficient, good	A-	A, A, B+
11	Mineral water gallon	Good, robust, affordable	A-	A, A-, A

Note : Score ≥ 80.00 (A); 77.00-79.99 (A-); 74.00-76.99 (B+); 68.00-73.99 (B); 65.00-67.99 (B-); 62.00-64.99 (C+); 56.00-61.99 (C); 45.00-55.99 (D); score <45 (E)

Table 5 above shows 11 affective products designed by each group. Each product has a different design concept. In this semester, all groups chose to redesign products, not services. The design concept results from selection using Principal Component Analysis (PCA). The group's score results from the group project value taken in week 15 during the final presentation. All group members must attend. Meanwhile, the final score is the student's final score which includes the results of the midterm and final exam scores. If we compare the group and final scores, there is a significant difference between the group and individual scores. The mid-term and final exams here serve to confirm individual abilities. The results show that of the 11 groups, only three showed consistent skills in working individually and in groups. The three groups are groups 4, 7, and 9. A total of 32 students who took the KEiAD course passed. The minimum score requirement is C. A summary of the results obtained can be seen in Fig. 3.

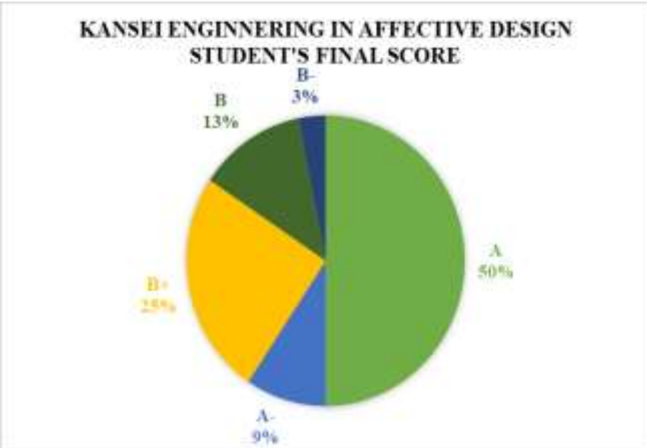

Figure 3. KEiAD student's final score

Beyond score distribution, the student design outcomes reveal how affective responses were translated into concrete design attributes through the Kansei Engineering process. While collaborative performance was generally strong, individual mastery of the analytical stages varied across students. In several projects, dominant Kansei descriptors such as comfortable, robust, and modern were consistently reflected in specific design attributes, including ergonomic proportions, material robustness, and restrained visual forms. This indicates that most groups were able to operationalize emotional perceptions into measurable and observable design elements, even though individual depth of methodological understanding differed. Such findings align with prior studies on Project-Based Learning that highlight the recurring tension between collective project outcomes and individual cognitive engagement. From an educational perspective, these results underscore the importance of balanced assessment strategies that capture both teamwork performance and individual analytical competence in research-based elective courses.

4.5 Measure Process and Improvement, these Stages Repeat Continuously

Overall, all students who took the class passed, but it is also necessary to review the achievement of the Course Learning Outcome (CLO) from the KEiAD class. The results of the CLO evaluation can be seen in Figure 4. This bar chart shows the achievement of Course Learning Outcomes (CLOs) of KEIAD class in odd semester 2023/24, comparing the number of students with "Excellent, Good and Enough" (blue) and "Poor" (orange) scores for each CLO (CLO1-CLO6); it can be seen that CLO1 and CLO2 were successfully achieved by all 32 students without any "Poor" scores, while CLO3 to CLO6 showed good achievement from the majority (27 students) but there were 5 students with "Poor" scores in each of these CLOs, indicating the need for further attention to the understanding of a small number of students towards learning outcomes CLO 3 to CLO 6.

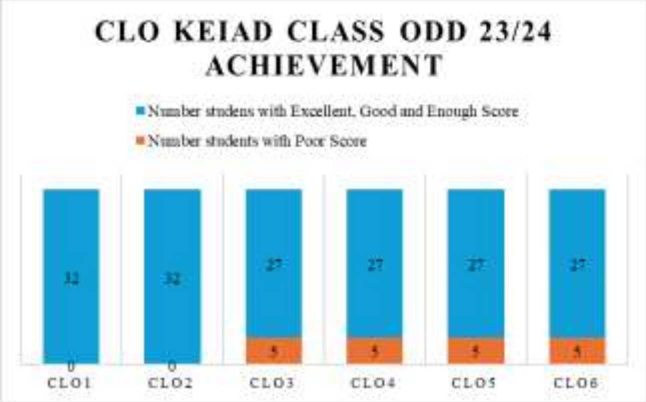

Figure 4. CLO achievement of KEiAD class

The five students who scored low in CLO4-CLO6 were the same. These students had been absent from class several times and did not perform well in their exams or assignments. The large number of students, 32 people, makes it difficult for the lecturer to test individual activeness in the project work of this elective course. Furthermore, the lecturer suggests that the elective course class be made into a smaller class with a maximum of 15 people so that intensive mentoring can be carried out. Small classes have several benefits, namely flexibility in learning time which allows for more intensive learning/teaching interactions; personal mentoring of each student can be increased; and students can identify themselves more and become attached to the class (Finn, 2019).

From an Outcome-Based Education perspective, these findings highlight the importance of continuous monitoring and refinement at the course level. Variations in CLO achievement, particularly in higher-order and practice-oriented outcomes, indicate that learning effectiveness is influenced not only by instructional design but also by class dynamics and student engagement patterns. Systematic reflection on attendance, participation, and assessment alignment provides a basis for iterative course improvement. In this context, reducing class size and strengthening formative monitoring mechanisms can be viewed as strategic adjustments to enhance learning consistency and support deeper attainment of course learning outcomes across diverse student profiles.

Evaluation of the process implementation of the KEiAD course is not only seen from the student's final score results. Two feedback questionnaires are given during the mid-term and final exams to evaluate course implementation. A comparison of the two questionnaire results can be seen in Table 6.

Table 6. A comparison of midterm and final exam feedback questionnaire results

Indicators	Midterm exam	Final exam
Exam mode and duration	Offline, on-site test, 160 minutes or 2 hours, paper-based, 25% of the final score.	Online, take-home test, 8 hours, computer-based, 25% of the final score.
Content	KE concept, Kansei words extraction, design concept questionnaire	Extracting affective design, Formulating affective design
Five dominant student's Kansei words	Comfortable (12), happy (11), calm (9), panic (7), difficult (6)	Happy (10), dizzy (10), difficult (9), confused (8), uptight (7)
Average score (1-100)	72.22	76.38
Exam score composition	A (16), A- (3), B+ (1), B (2), B- (3), C+ (1), C (1), D (3), E (2)	A (11), A- (3), B+ (4), B (8), B- (1), C+ (3), C (2), D (0), E (0)
Exam location	Campus (32)	Home (27), boarding house (2), vacation land (3)
Duration of taking the exam	2 hours	1-2 hours (6), 2-4 hours (15), 4-6 hours (11), 6-8 hours (0)
The question is difficult (nine-point Likert scale; 1 strongly easy – 9 very challenging)	9.4% agree, 34.4% moderately agree, 25% slightly agree	18.8% agree, 34.4% moderately agree, 31.1% slightly agree
I work honestly and don't cheat. (nine-point Likert scale; 1 strongly easy – 9 very challenging)	46.9% strongly agree, 18.8% agree, 18.8% moderately agree	40.6% strongly agree, 34.4% agree, 9.4% moderately agree

Table 6 shows the results of the two types of exams. Students are more comfortable taking the midterm exam, as seen from the five dominant Kansei words; the final exam is more complicated. This result is supported by 18.8% of students agreeing that the final exam was difficult. Compared with the average scores, the take-home test has better results where the average score is higher. Apart from that, all students can achieve the expected outcomes. Students' honesty is tested with a take-home test, and students consider the midterm results to provide an opportunity to be more honest in taking the exam. Both types of exams measure individual student abilities and have advantages and disadvantages. Further implementation of the KEiAD course can take these results into account.

The final questionnaire also asked about students' confidence in using KEiAD as a final assignment topic. The results showed that only one student was very sure, three were sure, five were moderately sure, five were slightly sure, and eight were undecided. Students also stated what they liked about this course. Namely, 75% answered the learning atmosphere, 65.6% liked the lecturer's way of teaching, 50% liked the material, 40.6% liked the method, and 15.6% liked R studio. The result supports that 75% of students do not like R studio because they feel it is difficult. Some suggestions from students for the future implementation of KEiAD are to reduce the number of student quotas so that they can provide more intensive guidance in working on projects. Apart from that, students also hope that the methods and software used will be more accessible.

The KEiAD class runs on the Even semester 24/25, with 11 students. The quota for each elective class has been reduced by the department to be more effective, and the elective courses presented are more varied. The department hopes that elective courses can help improve students' final assignments. Through this KEiAD class, 20 students have graduated and successfully published an article in the Sinta 2 journal with a harmonious living room redesign. In addition, there are currently three students working on their final assignments with the topic of Kansei engineering. In addition, a method update was also carried out by introducing multivariate statistics using Python based on Google Collaboratory.

5. Conclusion

It is possible to design elective courses from the lecturer's research interests. Kansei Engineering in Affective Design (KEiAD) is one example. This course provides an example of project-based learning in a student-centered learning class based on a research framework. The semester learning plan (SLP) is prepared following the Kansei Engineering framework to produce an affective design for a product or service. The five main steps to be considered in developing the KEiAD course are identifying user Kansei, selecting design concepts, identifying key design elements, formulating design, and prototyping.

Implementing the KEiAD course achieved good results, and all students managed to graduate with a minimum grade of B-, where the minimum requirement for passing was C. The student project results focused on products, none of which focused on services. In the future, the implementation of exams can maintain variations on-site (midterm exam) and take-home tests (final exam) because each has advantages and disadvantages. Students enjoy working on on-site questions more because the material is easier, while the final exam questions are more difficult even though they are take-home tests. The final exam processing time can be reduced to a maximum of 6 hours. Apart from that, alternative software to replace R Studio can be considered in the future.

This article gives an example of innovation in project-based assessment and constructive feedback. Furthermore, this research integrated Kansei Engineering theory into affective and effective teaching practice. This includes translating scientific findings into relevant and engaging classroom activities. The case studies provide empirical evidence of the effectiveness of the approach. Based on the limitations of the various student backgrounds, this method should be tested in different groups of students.

Beyond its pedagogical contribution, this study extends the application of Kansei Engineering by demonstrating its viability as an instructional framework in engineering education. The findings highlight how affective design methodologies can be systematically embedded into student-centered, project-based courses to strengthen the integration of research, teaching, and professional skill development.

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