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Applying Design Thinking In Higher Education: Interaction with Kolb's Four Learners – A Case At Da Nang University, Vietnam

Nguyen Thi Khanh Ha, Le Phuoc Cuu Long,
Vietnam - Korea University of Information and Communication Technology, University of Da Nang, Vietnam

Abstract: *Design Thinking is an innovative approach to problem solving that promotes hands-on and systems thinking. This study explores how Design Thinking can be applied in higher education to create an interactive learning environment that is appropriate to Kolb's four learning styles: Diverger, Assimilator, Converger, and Accommodator. Research confirms that Design Thinking is an innovative and effective learning method, especially suitable for higher education environments where students need to develop practical and creative skills to meet the demands of the modern labor market. Integrating Design Thinking with Kolb's learning style characteristics creates a flexible learning environment that encourages active participation and helps students explore their abilities through real-life experiences, while developing problem-solving and teamwork skills - core elements in education and future work.*

Keywords: *Design Thinking, Kolb's learning style, higher education, creative skills, innovative teaching methods.*

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I. INTRODUCTION

1.1 Background and Importance of the Study

In higher education, skills such as creative thinking, problem solving, and teamwork are increasingly important. However, traditional educational methods often lack interactive and hands-on elements, which limit the comprehensive development of students. Design Thinking is a powerful tool that helps students learn more proactively and approach knowledge through practice. This study focuses on the application of Design Thinking to meet the learning needs of students with different learning styles according to Kolb's model, in order to improve the effectiveness of higher education.

1.2 Problem statement

Kolb (1984) identified that students have diverse learning styles, divided into four main types: Divergers, Assimilators, Convergers, and Accommodators. Each learning style requires different approaches and activities to achieve maximum effectiveness. Therefore, this study will explore the applicability of Design Thinking to each student learning style, thereby helping to improve the learning experience and skill development for students.

II. THEORETICAL BASIS

2.1. Kolb's experiential learning model

David Kolb developed the experiential learning theory (ELT), emphasizing that learning is an experiential process to create knowledge through interaction with real-life environments (Kolb, 1984). According to Kolb's model, the experiential learning process consists of four main stages: Concrete Experience, Reflective Observation, Abstract Conceptualization, and Active Experimentation. Based on the combination of these stages, Kolb identified four main learning styles: Diverger, Assimilator, Converger, and Accommodator (Kolb, Boyatzis & Mainemelis, 2001).

2.2. Design Thinking in Education

Design Thinking is a creative thinking and problem-solving approach that helps learners explore and develop new ideas through a structured process. The basic stages of Design Thinking include Empathy, Define, Ideate, Prototype, and Test (Brown, 2009). This process is commonly used in product and service design, but is increasingly being used in education to develop learners' creative thinking, teamwork, and problem-solving skills (Razzouk & Shute, 2012).

Design Thinking supports the development of important skills for students, such as creative thinking, empathy and understanding of users, and teamwork (IDEO.org, 2015). The Empathize stage encourages learners

to listen and deeply understand the needs of others, while the Prototype and Test stages allow learners to experiment and refine ideas based on real-world feedback (Henriksen, Richardson & Mehta, 2017). Many studies have shown that with traditional learning methods, students often lack opportunities to practice and apply knowledge to real-world situations. Design Thinking provides an experiential learning environment that helps students develop the skills necessary for future practical work (Carroll et al., 2010).

In learning research, an individual's learning style has a major influence on how they perceive and process information (Honey & Mumford, 1992). Diverger learners tend to be more observant and reflective, which is consistent with the experiential and reflective stages. Assimilators, on the other hand, learn best through theory and modeling, favoring the conceptualization stage. Convergers and Accommodators are both action-oriented learning styles, with Convergers preferring to apply theory to practice and Accommodators preferring to experiment and adapt in real-world situations (Kolb, 1984).

2.3. Integrating Design Thinking with Kolb's Learning Model

Designing a curriculum based on Design Thinking needs to take into account each student's learning style, helping to optimize the learning experience. The stages of Design Thinking can be effectively combined with Kolb's learning styles, creating flexibility for each learner. Specifically:

- Divergers can develop their strengths in the Empathy stage, where they can observe and understand the problem from many different perspectives.
- Assimilators will find the Define and Ideate stages suitable for their ability to conceptualize and analyze theory, helping them to build models or systems of solutions.
- Convergers can be stimulated by the Prototype and Test stages, as they tend to enjoy applying theory and testing ideas in practice.
- Accommodators can utilize hands-on and adaptive activities during testing and prototyping to refine their ideas (Dunne & Martin, 2006).
- With this combination, Design Thinking not only supports the development of creative skills but also meets the need for personalized learning, which can have positive effects in higher education. Furthermore, stages such as Empathize and Identify the Problem help students improve their critical and analytical thinking skills, which are essential skills in both academic and professional life (Prince & Felder, 2006).

2.4. Overview of the benefits of a blended approach

Integrating Design Thinking into Kolb's learning model creates a multi-dimensional learning approach that meets the needs of different students. The stages of Design Thinking are designed to stimulate creativity, while providing space for students to develop through the stages of learning that Kolb identified. As a result, students do not only acquire knowledge through books, but also through practice, reflection, and experimentation. This helps build soft skills such as teamwork, creative thinking, and complex problem solving, which are very important in modern learning and working environments (Biggs & Tang, 2011).

III. RESEARCH METHODOLOGY

3.1 Research Design

The research uses mixed methods, combining in-depth interviews and surveys. The exercises were designed to suit each learning style, thereby assessing students' feedback and learning effectiveness through each stage of Design Thinking.

- *Prepare research tools*: Design a survey questionnaire to collect information about learning styles, assess each stage of Design Thinking, skill development, and suggestions for improvement from students.

The Likert scale was constructed with levels from 1 to 5, in which each level represents a specific level of agreement or satisfaction:

1 - Strongly Disagree or Strongly Disagree
2 - Disagree or Dissatisfied
3 - Neutral or Neutral
4 - Agree or Satisfied
5 - Strongly Agree or Strongly Satisfied

In the survey, the Likert scale was used to assess the stages of Design Thinking such as Empathy, Problem Identification, Ideation, Prototyping, and Testing. In addition, Likert was also used to compare the skill levels of students before and after applying the Design Thinking method (such as creativity, problem solving, teamwork, and critical thinking).

- *Data collection*: Distribute the survey to 200 students via an online platform and provide instructions on how to fill out the questionnaire. During this time, students will participate in a learning program that applies Design Thinking with practical activities.

- *Data processing*: Synthesize and analyze survey results to calculate the average score for each stage, the level of skill development before and after studying, and classify students' suggestions for improvement.
- *Results analysis*: Based on the data, determine the level of student satisfaction with each stage of Design Thinking, the effectiveness of this method in developing skills for students with different learning styles, and provide visual charts.
- *Results reporting*: Present the results in the form of tables and charts, and analyze in depth the suitability of Design Thinking for each learning style. The survey results will support the proposal of practical improvements for this method in the university environment.

3.2 Description of the research sample

- Subjects: The study focused on undergraduate students from various fields of study (Economics, Social Sciences, Information Technology, Natural Sciences, ...), from the first to the final year of the member schools of the University of Danang, Vietnam.
- Number of participants: A total of 200 students participated, evenly distributed across the fields of study to ensure high representativeness.
- Sample selection: The sample was randomly selected from students interested in developing creativity and problem-solving skills through practical learning methods.

IV. ANALYSIS AND RESULTS

4.1 Applying Design Thinking to Students' Learning Styles

4.1.1 Diverger

- Objective: Create opportunities for Diverger students to learn through observation and specific experiences.
- Application: In the Empathy and Define stages, Diverger students can perform activities such as interviews and case studies, helping them understand and empathize with the problem from many perspectives.

4.1.2 Assimilator

- Objective: Help Assimilator students analyze and organize knowledge logically.
- Application: The Ideate stage is very suitable for Assimilators, helping them apply theory to find solutions. Exercises such as building mind maps or working with theoretical documents will help these students organize knowledge better.

4.1.3 Converger (Action)

- Objective: To enable Converger students to experiment and apply in practice.
- Application: The Prototype and Test phases are suitable for Convergers, allowing them to test and refine their ideas through real models.

4.1.4 Accommodator (Testing)

- Objective: To encourage Accommodator students to experiment and create.
- Application: Accommodators can benefit from the Prototype and Test phases, where they can experiment and learn through teamwork.

4.2 Results

4.2.1. Distribution of Learning Styles of Students Participating in the Study

Learning Styles	Number of students	Rate (%)
Diverger (Reflective Observer)	55	27.5%
Assimilator (Abstract Thinker)	60	30%
Converger (Active Experimenter)	40	20%
Accommodator (Practical Experimenter)	45	22.5%
Total	200	100%

Table 1. Distribution of Student Learning Styles

- Assimilator (Thinking) - 60 students (30%):

This is the group of learning styles with the highest proportion in the study. Students with the Assimilator learning style often like to analyze theories and organize knowledge systematically. This result shows that a large proportion of students learn best through theory and logical thinking, and that teaching methods can focus on theoretical elements to meet the needs of this group.

- Diverger - 55 students (27.5%):

Diverger is the second largest learning style. Students in this group prefer to learn through observation and concrete experiences, often prioritizing reflection and observation before action. This distribution suggests that Design Thinking, with stages such as Empathy, may be suitable for the Diverger group of students due to its ability to help them better understand the context and feel the problem.

- Accommodator - 45 students (22.5%):

Accommodator is the third largest group of students, who prefer to experiment and learn through real-life experiences. This suggests that a segment of students has a high need for practical application of knowledge, and stages such as Prototype and Test in Design Thinking will support this group well.

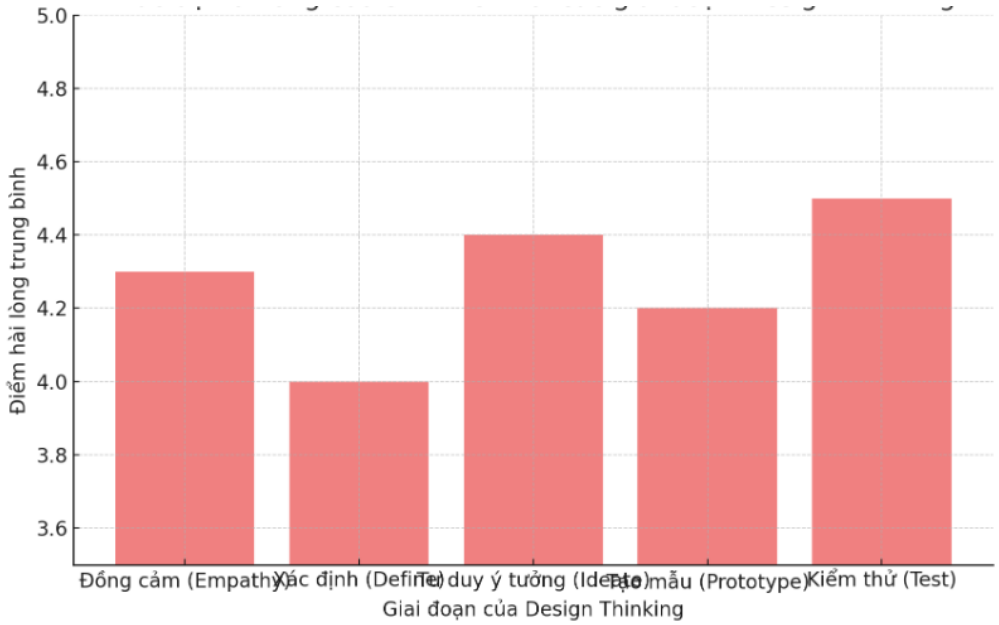
- Converger - 40 students (20%):

Converger is the group with the lowest proportion in the study. Students in this group often like to experiment and solve practical problems with specific approaches. Although this group has the smallest number, Design Thinking with practical activities and practical problem solving can still meet the needs of this group of students.

The distribution of learning styles of students is quite diverse, with the largest proportion belonging to the Assimilator group (30%) and the lowest proportion being the Converger (20%). This suggests that the Design Thinking teaching method can be customized to meet the needs of each learning style group. In particular, stages such as Empathize and Define the Problem will be more suitable for the Diverger and Assimilator groups, while stages such as Prototyping and Testing will support the Accommodator and Converger groups well. This distribution helps to orient the implementation of Design Thinking to optimize for the different learning styles of students in the study.

4.2.2 Student satisfaction with Design Thinking stages

Chart 1. Student Satisfaction with Stages of Design Thinking



- Test - 4.5/5:

This is the stage with the highest satisfaction level, with an average score of 4.5. This shows that students highly value the Test stage, possibly because it allows them to practically evaluate ideas, detect errors and improve solutions. This stage is highly applicable, suitable for students' need for practical experience and learning from trial and error.

- Ideate - 4.4/5:

The Ideate stage is also highly valued with an average score of 4.4, showing that students feel interested in creating and coming up with many ideas. This stage promotes creativity and freedom in thinking, creating an environment for students to maximize new ideas and solutions, suitable for their exploration needs.

- Empathy - 4.3/5:

With an average score of 4.3, students showed satisfaction with the Empathy phase, where they deeply understand the needs and feelings of others. This suggests that students see the value of putting themselves in the user's shoes to understand the problem, helping to build practical solutions that meet the user's needs.

- Prototype - 4.2/5:

The Prototype phase received an average score of 4.2, which is also a fairly high level of satisfaction. Students rated it positively because it allowed them to realize their ideas and consider the feasibility of the solution through a prototype. This suggests that students enjoy experimenting and learning from real implementation, strengthening their problem-solving and practical thinking skills.

- Define - 4.0/5:

The Define stage had the lowest satisfaction level of all stages, with an average score of 4.0. Although still rated positively, students may find this stage to be highly analytical and perhaps less enjoyable than other creative stages. However, this stage is an important foundation for clearly defining the problem, ensuring that proposed solutions are well-oriented.

Students had high satisfaction levels across all stages of Design Thinking, with an average score of 4.0 or higher. Overall, the practical stages such as Testing and Ideation had higher satisfaction levels, indicating that students enjoyed the creative activities, experiencing and adjusting ideas through practice. The Define stage had the lowest satisfaction score, possibly because it required analytical and systematic skills, and more detailed guidance was needed to help students see its value in laying the foundation for the next stages.

This table of results shows that Design Thinking is a method that is positively received by students, especially in the stages of promoting creativity and practical application.

4.2.3. The Suitability of Design Thinking for Different Learning Styles

This content helps to assess the suitability of each stage for different types of learners, thereby clearly illustrating that different groups of learners approach different stages differently.

The survey results show that all four of Kolb's learning styles can benefit from Design Thinking to learn effectively. Each group tends to prefer certain stages of the process, such as Diverger students prefer the Empathize stage, while Converger students value the Test stage.

Stage	Diverger	Assimilator	Converger	Accommodator
Empathy	4.5	3.8	3.9	4.0
Define	4.1	4.3	3.7	3.8
Ideate	3.9	4.5	4.0	4.1
Prototype	3.8	3.9	4.6	4.4
Test	4.0	3.7	4.5	4.2

Table 2. Compatibility of Design Thinking Stages with Learning Styles

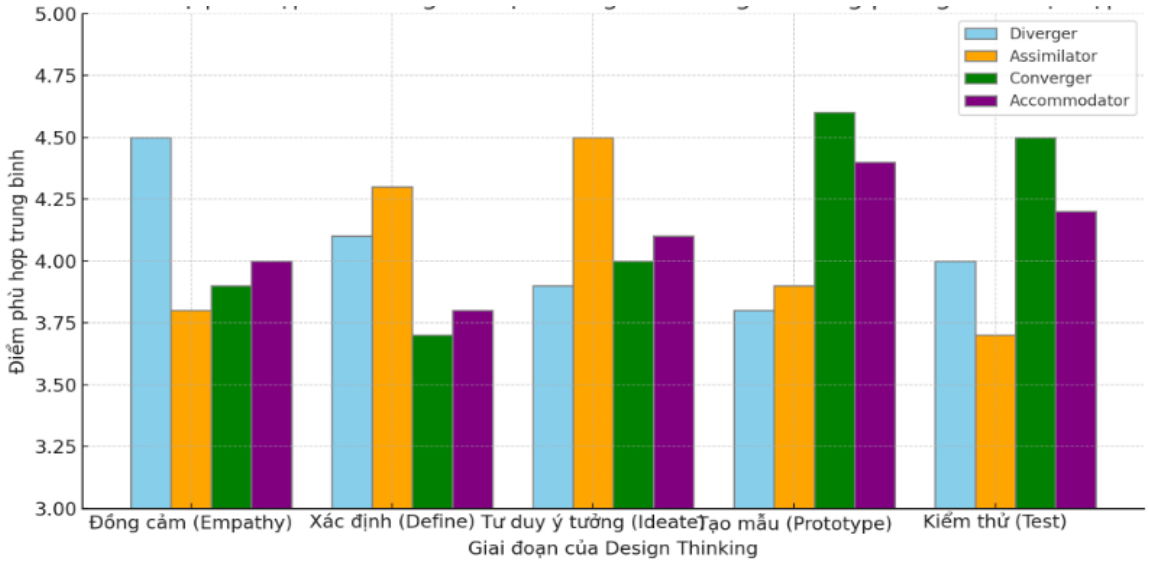


Chart 2. Compatibility of Design Thinking Stages with Learning Styles

4.2.4. Skill Improvement

This section compares student skill development before and after applying Design Thinking.

Skills	Average Score Before (out of 5)	Average Score After (out of 5)	Growth (%)
Creativity	3.0	4.5	50%
Problem Solving	3.2	4.3	34.4%
Teamwork	3.4	4.2	23.5%
Critical Thinking	3.1	4.1	32.3%

Table 3. Skill Development Before and After Applying Design Thinking

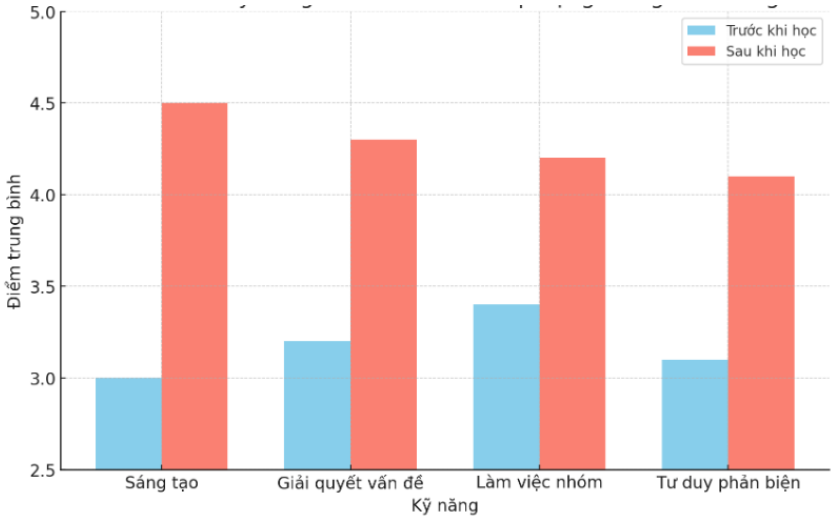


Chart 3. Skill Development Before and After Applying Design Thinking

- Creativity:

The average score before applying Design Thinking was 3.0 and after applying it increased to 4.5, with a growth rate of 50%.

Creativity showed the highest increase in skills, showing that Design Thinking has a very positive impact on students' creativity. This method encourages students to think outside the box, develop new and diverse ideas, consistent with the characteristics of the Ideate stage.

- Problem solving:

The average score increased from 3.2 to 4.3, equivalent to a growth rate of 34.4%.

This improvement shows that Design Thinking has helped students improve their problem-solving skills, an important skill in real-life learning and working environments. Steps such as Define and Test of Design Thinking support students in analyzing and testing possible solutions.

- Teamwork:

The average score increased from 3.4 to 4.2, a growth rate of 23.5%.

Although the increase was not as high as other skills, it still showed that Design Thinking contributed to improving students' teamwork skills. Practical and experimental activities required collaboration, sharing of ideas and working together, helping students improve these skills.

- Critical Thinking:

The average score before the course was 3.1 and after the course was 4.1, a growth rate of 32.3%.

Critical thinking skills improved significantly, showing that Design Thinking helped students analyze and evaluate ideas more logically. The Empathy and Define stages provided opportunities for students to develop critical thinking and look at problems from different perspectives.

Design Thinking helped students comprehensively develop necessary skills, especially creativity and problem-solving skills. These skills had the highest growth rates, indicating that this approach is consistent with the instructional goals of enhancing students' creative thinking and practical skills. However, teamwork skills had lower growth rates, suggesting that additional group activities or specific instructions may be needed to optimize the effectiveness of this approach in building collaboration skills.

4.2.5. Suggestions for Improvement from Students

This section summarizes suggestions from students to improve Design Thinking to better suit their learning needs, giving readers a better understanding of possible adjustments in education.

Improvement Suggestions from Students	**Percentage of Students Suggesting Improvement**
Increase observation time	40%
Provide additional theoretical materials	35%
Provide more detailed guidance	50%
More hands-on opportunities	45%
Increase group work duration	60%

Table 4. Improvement Suggestions for Design Thinking from Students

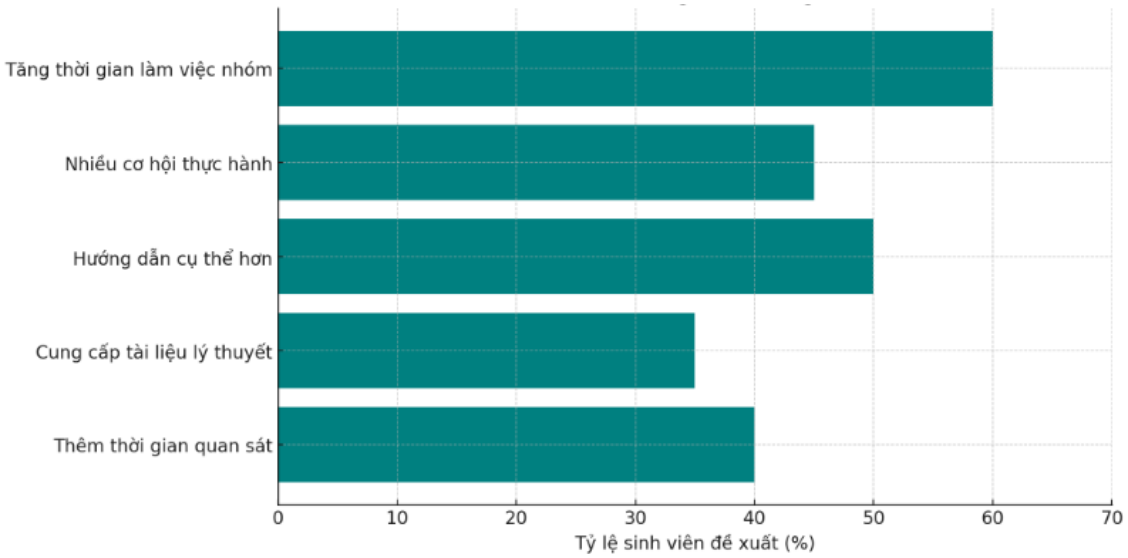


Chart 4. Improvement Suggestions for Design Thinking from Students

- Increasing the duration for group activities would enhance collaborative learning (60%):

This was the most popular suggestion, indicating that students felt they needed more time to work together, exchange ideas and collaborate during their learning. This also suggests that Design Thinking, as a collaborative learning method, could be better served by more structured and extended group activities.

- Providing more detailed instructions could help students better understand each stage (50%):

Half of the students wanted more detailed guidance, indicating that some parts of the Design Thinking process, or how to implement its stages, were not clearly presented. Providing more specific guidance would help students understand how to do each step, avoid confusion and increase learning effectiveness.

- More practice opportunities (45%):

Nearly half of the students suggested more practice opportunities, reflecting that students wanted to apply their knowledge to more real-life situations. Design Thinking is an experiential learning method, so adding more practical activities will help students consolidate their skills and flexibly apply theory to practice.

- Allowing additional observation time in specific stages may benefit students who prefer reflective learning (40%):

40% of students want more time to observe and reflect, showing that some students need time to learn, evaluate and empathize with problems before coming up with solutions. This is consistent with the Empathy stage in Design Thinking, when students need time to deeply understand problems from multiple perspectives.

- Providing theoretical materials (35%):

Some students want more theoretical materials to supplement the learning process. This may show that, although Design Thinking focuses on practice, students still feel the need for background materials to better understand the theory of this method and apply it effectively to practical exercises.

The above suggestions for improvement show that students appreciate the Design Thinking method but also want more support and organization to optimize the learning process. In particular, increasing group work time and providing detailed instructions were two suggestions that were supported by many students, emphasizing the importance of creating conditions for students to interact and work effectively in groups, while having clear instructions at each stage of the process. This suggests that redesigning the process and adding supporting elements would help Design Thinking work better in educational environments.

V. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Design Thinking proves highly suitable for higher education by personalizing the learning process and optimizing students' experiences.

The survey results show that students have a high level of satisfaction with the Design Thinking method, especially in the Test and Ideate stages. The Diverger group of students highly appreciates the Empathy stage, which allows them to observe and understand the problem from many different perspectives. In contrast, the Assimilator group prefers the Define and Ideate stages, which help them analyze and model the theory. For students in the Converger and Accommodator groups, the Prototype and Test stages are considered the most suitable, allowing them to test and adjust the solution flexibly and practically.

In terms of skill development, Design Thinking brings significant improvements. Specifically, students' creativity scores increased significantly, with a growth rate of 50% compared to before the course. Problem-solving and critical thinking skills also increased by 34.4% and 32.3% respectively, showing that Design Thinking not only develops creativity but also helps students analyze and handle problems systematically. Teamwork skills were also improved, reflecting the need for collaboration and exchange of ideas throughout the learning process. However, the study also showed that some students felt that more time was needed to complete the observation and Define stage, and desired more specific theoretical materials and instructions. Students also suggested increasing the group work time to be able to discuss and develop ideas more deeply. These proposals demonstrate the potential for innovation in Design Thinking when applied to education, and also indicate that tailoring the stages to suit individual learning styles can enhance its effectiveness.

5.2 Recommendations

- Teacher training: Universities should organize training courses for teachers to understand and apply Design Thinking in teaching.
- Create practice conditions: Universities should ensure access to appropriate facilities and experiential opportunities for students to fully engage with the Design Thinking process.
- Customize according to learning style: Encourage teachers to flexibly use Design Thinking to suit each student's learning style, creating a diverse and applicable learning environment.

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