Heuristic Strategies: Achieving Influence Motivation with Success to Design Industrial Products in Projects from the Department of Architectural Education and Design

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Abstract—This research aimed to study the achievement of motivation from the learning procedure of heuristic strategies. Besides, it resulted in the success of design product projects from the students in the Department of Architectural Education and Design, King Mongkut's Institute of Technology Ladkrabang with the learning comparison method and student satisfaction between control groups for normal study and experiment groups with heuristic strategies. This research studied the results from fourth-year student groups studying in the curriculum of Architectural Education and Design. A total of forty-four people were selected by using the observation method and asking for satisfied attributions in the groups to represent the score levels from the personal project assessment. In this case, it also used a 5-point rating scale to make t-test data analysis for Independence with results comparison, and it was found that the experiment group studying with heuristic strategies had the testing scores of the personal project assessment in the higher level than the controlling group with studying in a normal way with statistical significance at the level of .05, including with the reliability assessment from the students in the designing product project, which found that the experiment group with studying for heuristic strategies gaining the reliability level from the personal project at a higher level than the controlling group with studying in a normal way with statistical significance at the level of .05.

Keywords—Achieving influence motivation, Design, Education, Heuristic strategies, Industrial products, Learning, Students

1 Introduction

According to the strategies, the gaining of effective design knowledge can be represented conforming to the alteration of the 21st century for students of industrial design products. Besides, it shows that it is significant for teachers in product design nowadays to have the essential ability for learning procedure development conforming to the alteration of current and future world situations. In this case, it applied the teaching method focusing on talented skills or thinking skills as basic

skills that are not involving with multiple sciences such as marketing, psychology, environment, or technologies, resulting in significant opportunity to create long-term effects for the students. Then, they may lack the applied thinking skills and integration thinking skills from knowledge as the big data. In addition, the 21st century represents world-changing impact with the increasing connections of sciences including the beginning of innovation created for the modern world age. Thus, knowledge is essential based on the industrial product designers with attaining high flexibility to use the applied ideas and the integration thinking during the creative design procedure of the industrial product design. As a result, innovative product design in the future will be reliant on the designer's thoughts with the activeness to apply the thinking skills of the 21st century with high effectiveness to be accounted as the brain potential development for the students in this age with effectiveness [1].

According to the applying of McClelland's Achievement Motivation Theory in this research, it can be applied as the motivation guideline with requirements to be successful for the designing works from the personal project of the students with the Standard of Excellence. In this case, according to the regulation of the curriculum of design education it aided to receive the learning assessment result from the students in the curriculum, [2] including with basing on the stimulation for feeling requirements with the potential development, using with the need for achievement, need for affiliation and need for power. Therefore, it resulted in the successful requirement from the student group contributing to the giving on importance of the future image by learning and management with effectiveness and good efforts [3-4].

Besides, according to the learning in the curriculum of design education for the fourth-year student, it must be approved from the industrial product design management as a single project [5]. Therefore, it should focus on the industrial product development to the response of the customer groups, the manufacturer groups, the seller groups, and the relevant groups of industrial products and others. Then, according to the industrial product design project, it must accept the problems by noticing from the basic data collection before demonstrating with the solutions of acceptance method from the development procedure to the active model result. Thus, the students must gain the thinking skill procedure for applying and integrating the knowledge in multiple sciences with learning processes and selecting for the subjects from the personal project. However, normally it challenges with the problems of controlling for the work quality with the industrial product design to attain the high scores value and the quite low scores value differently. With this case, it affected the learning procedure development and the selection of subjects to the personal project of the students in the academic year. Furthermore, according to these problems it is relating with the students to be lacked from using various data by connecting with the relationships differently from the flexible thinking skills to gain the decreasing level of the presentation method's effectiveness. In this case, According to the heuristic strategies, it is accounted as the integration with the learning pattern for stimulating the learners to use the rational method, [6-7] including for applying these strategies to control for the personal project with good quality, especially for the students in the curriculum of design education with the realization stimulation of rational attribution

for each data, [8] before contributing to the synthesizing procedure for solving the problems of industrial product design with a high level of effectiveness.

Therefore, according to the heuristic strategies for the students of industrial product design it had the objective to make the achievement motivation with the success on the industrial product design project as these methods: 1) Motivation creation with successful opportunity in future work for the students after graduation in this curriculum. 2) Motivation creation with an opportunity to be the leaders in the group for practicing a job in organizations or industrial factories. 3) Motivation creation from practicing with advanced data analysis technique in organization with active way and other methods. Then, these three methods will stimulate the students to achieve in their future works contributing to the knowledge creation step as being the significant skills for the students in the curriculum. In this case, it was shown that there are four fields according to the above details, such as analytical thinking skills, synthesis thinking skills, flexible thinking skills, and designing skills as well as others. Further, all fields are the main objectives to stimulate gains in the integration of thinking skills with the students in the curriculum of design education from King Mongkut's Institute of Technology Ladkrabang, Thailand.

2 Materials and Methods

2.1 Objective

This work aimed to make a comparison of learning results and the satisfaction of students in curriculum of design education between the normal study group and the heuristic strategies study group.

2.2 Scope

Population: the fourth-year student group studying in the curriculum of design education from Faculty of Industrial and Technology Education of King Mongkut's Institute of Technology Ladkrabang with Academic Year of 2020-2021 classified as the registered ones in Academic Year 2/2021 with a total of forty-four people.

Group Sampling: the fourth-year student group studying in the curriculum of design education from Faculty of Industrial and Technology Education of King Mongkut's Institute of Technology Ladkrabang in Academic Year of 2020-2021 with totals of forty-four people classified into the two empirical groups (see Table 1).

Research Tool: Learning result assessment in personal project subject of the students with satisfaction by expressing with the presentation from noticing and asking about requirements of 5 Rating Scale, [12] including of using the satisfied attribution assessment for the experiment group, [13-14] from thirteen lists of potential assessment for the students that the researcher has checked the quality of Index Item Objective Appropriation Assessment to find the validity by the education and designing experts with ten people according to the standard of IQA with the objectives, (Mean=4.25, S.D.=0.57).

Data Analysis: Means and Standard Aviation or S.D. and t-test for Independent for making a comparison with learning result between two group samplings.

Table 1. Classification between the Controlling Group and the Experiment Group by Using the Different Learning Pattern for Each Group of Students

| Learning and Teaching Pattern	Measurement Pattern	Assessment Method
Group 1: Controlling Group <u>Normal Learning Pattern</u>: Teacher-Centered Learning to give information and set up the learning based on teachers' knowledge	➤ Measurement by using Teacher-Centered Learning to show the project result	1) Use for each teacher standard to the project assessment 2) Asking and opening chances to answer questions 3) Having result assessment attribution of a personal project with the lists
Group 2: Experiment Group <u>Heuristic Strategies Learning Pattern</u>: Gaining knowledge from consideration and showing of the guidelines by themselves in the system [9].	➤ Measurement by using list standard from noticing of satisfied attribution in a personal project [10].	1) Using result standard assessment with scores as satisfied attribution in a personal project [11]. 2) Having questions to ask and opening chances to answer questions 3) Having notification of details for giving scores in assessment openly to the students 4) Showing of students' scores and making a comparison between scores and average scores to express the high and low scores of each class

2.3 Research Framework
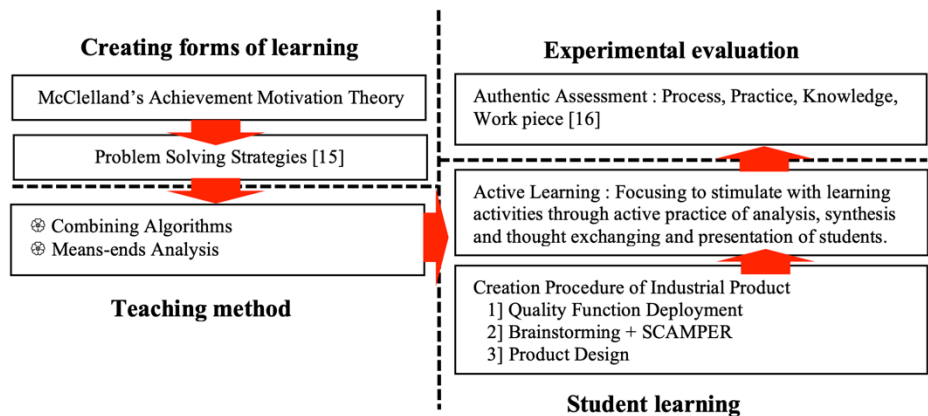
Fig. 1. Working framework

3 Results

According to use the heuristic strategies with the thinking procedure in system of the students in the curriculum of design education to be applied with solving the responding design problems as this following, [17]: 1) Requirements of customers 2) Requirements of market 3) Manufacturing of Industrial System 4) Friendliness to environments and others. Besides, each student should express the efforts to present the selection of design with solutions including showing supporting selection data with suitable reasons. Then, all information can result in the solving problem skills with flexibility through behaviors and personal projects of the students consisting of five skills:

1. Thinking Analysis Skills: The students can separate the components of product design problems by themselves suitably based on the analysis method with SWOT & TOWS and SCAMPER techniques.
2. Applied Thinking Skills: The students can show the analysis data for applying as the solving problem guideline with brainstorming through the presentation in various patterns based on the flexible thoughts to create the high effectiveness ideas.
3. Integration Thinking Skills: The students can show the evidence of information to promote the solving problem method by considering with effectiveness; thus, it can apply the principles or not involving technique or solving problems for using the different techniques or procedures suitably, such as Quality Function Deployment: QFD and Analytic Hierarchy Process: AHP
4. Creative Skills: The students can show their thought potential freely with the ability of guideline presentation with solving problems differently from original ones with suitability. Then, it becomes to be the solving guideline of product design to respond to specific problems in situations.
5. Information Skills: The students can show the communication skills or the technical skills in the current day to apply with the personal project for the presentation of industrial product design works suitably through the models of YouTube and line applications including with the only presentation works for MS Tame and others.

According to the thinking procedure of Heuristics, it can be applied with suitability for leading the students to search for the solving problem solutions as requirements by aiming to consider of the selection and good reason with making explain and select the result shown in Table 2.

According to the determination of heuristic strategies, it used the desirable characteristics of students congruently with the goal of personal project subject. With this case, with the next step, it can use the achievement motivation with the integration in learning procedure of the design education students as the experiment group with totals of twenty-two people. In addition, it can increase the motivation

Table 2. Solve Problem Strategies with Heuristics for the Design Education Student Group

Thinking Method of Heuristics Pattern	Management: Thinking Procedure of Heuristics to be applied suitably for leading the students to search for the required solving problems as the selection and reason for explaining and selecting the result	Applying		
		Quality	*Quantity*	*Technique*
1) Searching Problems to Solve	➢ Learn and make understand to the problem contexts.	✓	✓	
	➢ Classify the relevant subjects with problems.	✓	✓	
2) Planning Step to Solve the Required Problems	➢ Determine steps and plan to gather relevant data.			✓
	➢ Determine details with data management.	✓	✓	
3) Management Step with Plan	➢ Analyze problems with data and conclude details, [18] and practice theories and interpret from actions, (Hermeneutics) [19-20].	✓		✓
	➢ Present the solving guideline with brainstorming procedure.	✓		✓
	➢ Create the details to consider for each solving presentation guideline [21].		✓	✓
4) Checking of Correctness and Possibility for Required Problem Response [22]	➢ Select the best solving guideline leading to the effective product design procedure.			✓
	➢ Create the product model with the real test.			✓
	➢ Present for result in a personal project of students to the evaluation committees in subject with participation between classmate groups [23].	✓	✓	✓

with giving knowledge including with image creation to be successful in life as the future times; thus, the experimental student group can see the result from the opportunity of the personal project management:

1. The incomes earned after setting up the personal product design project.
2. The building up of opportunity to increase the economic values in the future for becoming as small industrial entrepreneurs [24].
3. It involves with stimulation of requirements to gain acceptance [25], including registering patents for designing national products to view the possible opportunity in the future when the students show satisfying behaviors.

According to the above detail, the researcher has brought the guideline into the achievement motivation with stimulating the students to put the efforts for interpreting with the empirical data or availability to Hermeneutics that is the meaning of information from the effort actions leading to the success as the last goal [26]. In this case, it appears in the personal project of the students to express as the satisfied behaviors of the subject: 1) Designing Works, 2) Writing Documents, 3) Presenting, and 4) Beauty of works and others.

Thus, it can determine the behaviors with requirements from the expression of students, and the researcher has taken assessment from the achievement motivation from the two groups of students with a total of forty-four people, as shown in Table 3.

Table 3. The feeling from achievement motivation before the beginning of two experiment learning procedures

Assessment Lists	Controlling Group (n=22)		Experiment Group (n=22)		Comparison	
	mean	*S.D.*	*mean*	*S.D.*	*t*	*Sig.*
1)Achievement Needs of Personal Designing Project	4.36	0.49	4.45	0.51	0.602	0.275
2)Expectation to Stable Career and Good Incomes in the Future	4.82	0.39	4.77	0.43	0.366	0.358
3)Internal Feeling inside: creative level and flexible thoughts	4.14	0.56	4.18	0.66	0.245	0.404
4)Feeling inside: knowledge level of product design	4.00	0.62	4.09	0.61	0.491	0.313
5)Feeling inside: accepting requirements from other people in society	3.73	0.63	3.91	0.61	0.972	0.168
Achievement Motivation	4.21	0.65	4.28	0.64	0.837	0.202

According to Table 3, it was found that before beginning the experimental test of the new learning procedure the controlling group had the normal study attribution with stimulation for the learners in excellent level, (Mean=4.21; S.D.=0.65). In addition, the experiment group had the Heuristics strategies learning pattern from the internal stimulation for the students in excellent level, (Mean=4.28; S.D.=0.64). Thus, according to the two groups of learning patterns, it wasn't shown the differences in significance with a level of .05 with a similar level of motivation to stimulate the students for requiring of achievement.

According to the test result in Table 3, it showed that the two groups of experiment ones had the achievement motivation in the average level with no difference. Thus, it has resulted in the testing step by matching with the controlling group by applying the original learning pattern or teacher-centered study. Additionally, according to the experimental group it had brought the heuristic strategies to integrate with the additional learning procedure. With this case, it can notice for the result of scores levels in the personal project of the product design students based on the assessment procedure of project presentation through the online system of MS Tame application.
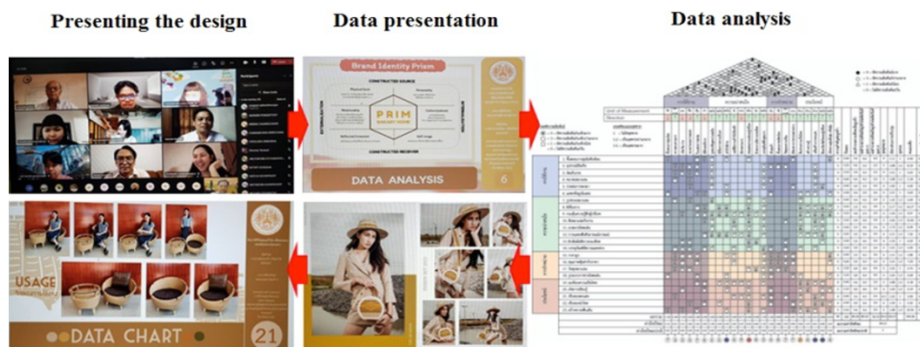

Fig. 2. Result Assessment of Personal Project from Problem Acknowledgement of design to the testing step of product model use

According to the result assessment of the personal project for students shown in figure 1, it can take an assessment of the result with the scores level value from the two groups of students. Then, it can show the details from the rating assessment in each field according to the heuristics strategies of designing education student group to be the framework for assessment, as shown in Table 4.

Table 4. Comparison of Results from Two Learning Patterns

Assessment List	Controlling Group (n=22)		Experiment Group (n=22)		Comparison	
	mean	*S.D.*	*mean*	*S.D.*	*t*	*Sig.*
➢Problem Searching	3.52	0.66	3.86	0.80	2.183	0.016*
1) Basic understanding of problems with requirements	3.64	0.58	4.00	0.69	1.891	0.033*
2) Analyzing skills and classifying of issues with guideline presentation for solving problems	3.41	0.73	3.73	0.88	1.300	0.100
➢Planning Steps for Solving Problems with Requirements	3.16	0.75	3.57	0.85	2.406	0.009*
3) Suitability of Step with Relevant Plan Collection	3.05	0.79	3.18	0.73	0.595	0.277
4) Suitability of Data Setting or Data Analysis	3.27	0.70	3.95	0.79	3.035	0.002*
➢Management Steps with Plan	3.00	0.91	4.00	0.89	6.362	0.000*
5) Perfectness to make summary for solving problems and applying in solving theory	2.82	0.91	3.77	1.15	3.054	0.002*
6) Presentation Guideline with Brainstorming	3.00	1.11	4.14	0.71	4.038	0.000*
7) Fullness of Details with Presentation Guideline	3.18	0.66	4.09	0.75	4.255	0.000*
➢Correctness and Possibility for Problem Response	2.98	0.73	4.09	0.65	9.168	0.000*
8) Selection of Solving Guideline into High Effective Product Design	2.91	0.81	3.95	0.79	4.343	0.000*
9) Suitability of Real Testing Product Model	2.95	0.79	4.09	0.53	5.637	0.000*
10) Result Presentation of Personal Project	3.09	0.61	4.23	0.61	6.168	0.000*
➢Expression with Intelligence	3.11	0.77	4.00	0.76	6.705	0.000*
11) Participation for Opinion Exchanging	3.41	0.67	4.09	0.68	3.350	0.001*
12) Correctness and Suitability for Opinion Expression	3.18	0.66	3.77	0.87	2.533	0.008*
13) Stimulation to make progression of personal project study into the own business	2.73	0.83	4.14	0.71	6.063	0.000*
Result	3.12	0.79	3.95	0.80	13.810	0.000*

* Difference with Statistical Significance at a Level of .05

According to Table 4, the comparison of results is shown from two learning patterns with heuristics strategies as the testing score levels from the personal project in the excellent level, (Mean=3.95; S.D.=0.80). In this case, it had higher scores more

than the controlling group with the normal learning pattern of teacher-centered as the scores in moderate level, (Mean=3.12; S.D.=0.79). Then, according to the t statistic test, it was found that the average scores of a personal project for the students studying with heuristic strategies were at a higher level than the normal group with statistical significance at the level of .05.

According to the result assessment from two learning patterns, it represented the differences with statistical significance. Later, an assessment of design reliability value was undertaken with the student group before making the result effectiveness assessment of learning attribution to apply in the personal project, as shown as the satisfaction value in Table 5.

Table 5. Reliability Level Value of Reliability Level for Design of Students in Two Patterns

Self-Assessment List of Students after Learning (Assessment of Students with Feeling inside: Confidence Result from Stimulation)	Controlling Group (n=22)		Experiment Group (n=22)		Comparison	
	mean	*S.D.*	*mean*	*S.D.*	*t*	*Sig.*
➢Problem Searching	3.80	0.51	4.25	0.58	3.922	0.000*
1) Ability to Recognize and Make Understand about Problems	3.95	0.49	4.18	0.59	1.397	0.085
2) Ability to analyze and classify problem issues	3.64	0.49	4.32	0.57	4.255	0.000*
➢Planning Step for Solving Problems with Requirements	3.25	0.72	4.09	0.64	5.792	0.000*
3) Ability to plan from gathering relevant information	3.36	0.79	4.14	0.64	3.567	0.000*
4) Ability to analyze information	3.14	0.64	4.05	0.65	4.665	0.000*
➢Management Step with Plan	2.93	0.62	4.23	0.60	9.881	0.000*
5) Ability to make summary for applying in design	2.91	0.61	4.05	0.58	6.355	0.000*
6) Ability to brain storming for solving problems	2.95	0.65	4.41	0.59	7.750	0.000*
➢Correctness and Possibility for Problem Response	3.73	0.73	4.09	0.64	2.490	0.007*
7) Self-Creative Design Potential	3.36	0.58	4.00	0.62	3.521	0.001*
8) Ability to Result Design Presentation for Personal Project	4.09	0.68	4.18	0.66	0.447	0.329
➢Expression of Intelligence	3.42	0.70	4.11	0.66	5.747	0.000*
9) Knowledge of Thinking Analysis	3.77	0.61	4.14	0.64	1.927	0.030*
10) Knowledge of Synthesis Thinking	3.27	0.77	4.00	0.69	3.306	0.001*
11) Knowledge of Applied Thoughts	3.23	0.61	4.18	0.66	4.956	0.000*
➢Satisfaction to Learning Pattern	3.59	0.79	4.34	0.64	4.889	0.000*
12) Happiness and Joyfulness in Learning	4.00	0.62	4.18	0.66	0.940	0.176
13) Stimulation with Increasing Efforts	3.18	0.73	4.50	0.60	6.539	0.000*
Result	3.45	0.74	4.18	0.63	12.666	0.000*

* Difference with Statistical Significance at a Level of .05

According to Table 6, there is a correlation with the assessment results of the students after learning from the feelings. Then, according to the reflecting of the confidence with the stimulation, it was found that the experimental group had the learning pattern with Heuristics strategies as the personal project result in an excellent level, (Mean=4.18; S.D.=0.63). In addition, it had a higher level than the controlling group with the normal study group to the personal project in the moderate level, (Mean =3.45; S.D. =0.74). With this case, when testing with t statistic it was found that the average confident reliability value with the stimulation of the learning group with Heuristic strategies had the achievement requirement of product design in the higher level than the normal study group with significance at the level of.05.

When it has analyzed the attributions of the students with requirements for the curriculum of design education, it was found as these details: 1) Searching problems 2) Searching planning step with requirements 3) Management step with plan 4) Correctness and the possibility to respond with problems 5) Expression of intelligence 6) Satisfaction of learning pattern

Then, according to the six confident assessment lists it was found that it resulted from the stimulation to be the force of new design product work in the personal project. In this case, when test with t statistic it was found that there was the average value from the confidence level to the satisfaction attribution of the design education curriculum. As the result, according to the six fields, the student group to study with Heuristic Strategies had the average value to the personal project management in the higher level than the normal learning group with statistical significance at the level of.05.

In addition, according to the sub-assessment, it had the average value of the confidence to the students in a personal project with no statistical difference at the level of.05 for the learning group of heuristic strategies and the normal study group consisting of three fields:

1. Ability of recognition and understanding problems: confident level for the students with stimulation from two learning patterns in a similar level, (Mean=3.95; Mean=4.18) with no statistical difference at the level of .05. Then, the students in two groups had the feeling to recognize the research problem issues and the requirements to solve problems with no difference. Thus, the students could see the importance of the problems from the surrounding environments without motivation or the achievement requirement to the designing problems. Finally, it resulted in the confidence level values from the two group students with no difference.

2. Ability to design a presentation for a personal project: confident level of students from two learning patterns of stimulation in a similar level, (Mean=4.09; Mean=4.18). Besides, it was shown to have no statistical significance at the level of .05 because these two student groups were aged between 20-22 years old, meaning they were of an age for good ability to use technology and modern applications for presentation at similar levels. Therefore, it resulted in the confidence level for the two student groups with no difference.

3. Happiness and joy in learning: similar confident level of students from stimulation in two learning patterns, (Mean =4.00; Mean=4.18) with no statistical difference at the level of .05

Besides, these two student groups had the amusement feeling in learning with no statistical difference, and the causes of happiness and joyfulness in learning aren't depending on the motivation with the student groups or from the designing behaviors. However, it is relying on the happiness and the joyfulness from learning with the relaxation until becoming as the positive feeling to learning. Then, it showed that the normal study pattern and the learning with Heuristics strategies resulting in the positive attitudes affecting the happiness and the joyfulness in the two study patterns were at a similar level.

According to the conclusion, it can make a comparison to the results from the two learning patterns. Then, the learning group with Heuristics strategies had the testing score levels and the confident assessment level for the personal project at a higher level than the normal study pattern with statistical significance at the level of.05.

When considering the research results with the score level and the confidence level to the student personal project, it represented the same direction for making confirmation about the learning pattern with heuristic strategies. Thus, it can stimulate receiving confident feelings to the personal project consisting of problem recognition, data gathering, planning, analyzing, applying, testing, presentation and exchanging ideas and others. Additionally, the learning with heuristic strategies enabled to promote and push up for the requirement feeling to be achieved by expressing with satisfied behaviors as behalf of the design education students with the subject objective. As the result, it resulted in gaining the score value level for a personal testing project with a higher level of heuristic strategies and confidence in creative design effectiveness.

4 Discussion and Conclusion

1) According to the achievement motivation with the test for the two learning patterns, it consists of the normal learning group and the learner group with heuristic strategies. Similarly, the test assessment with the stimulation force resulted in making student achievement for the personal project management. Additionally, the two learning patterns showed there was a normal learning group and a learning group with heuristic strategies from the motivation assessment, contributing to achievement in a personal project. Thus, the two groups of learning patterns had the motivation level with no statistical significance, which resulted from the achievement required for the two student groups with no difference. Later, the result was applied to formulate confirmation of the suitability for the two student groups before beginning the test procedure. Then, it can increase motivation through the learning procedure with heuristic strategies from the testing group with a similar level of achievement by gaining the higher level of intelligence and confidence development in the experiment groups [27-28], including of being the determining factor to be achieved in academics for university-level education [29-30].

2) When comparing the learning results with the two methods, it consists of the original learning pattern using modern teaching and the learning with heuristic strategies as the objective to stimulate for gaining thinking procedure, reviewing, and systematic decision making. Then, they are counted as significant skills for students to be important persons to create a social movement in the near future [31-32]. In addition, it was found that the achievement motivation had no difference when testing for the two learning patterns. Thus, it was shown that fourth-year design education students had the mental requirements to be successful in personal project management. Further, knowledge level represented whether the students had the intellectual skill levels in systematic thinking with the high opportunity to be graduated in the future [33]. Thus, it is based on systematic thinking with clear steps aiding for the design product students to design and make industrial products with responding to the customer requirement in high effectiveness, especially for the students who may lack clear systematic thinking [34-35].

According to the results compared with the assessment scores level from committees in student personal project with concreteness, the student group had the learning pattern with heuristic strategies in the higher scores level than the normal study group with statistical significance comparing from the most level to the least level: 1) Management with planning step 2) Planning step with required solution 3) Satisfaction to learning pattern 4) Expression of intelligence 5) Search of problem 6) Correctness and the possibility to response with problems and others. Additionally, it has compared with the project assessment scores from the most level to the least level: 1) Correctness and the possibility to respond with problems 2) Management with planning step 3) Expression of intelligence 4) Planning step with requirements and others.

In addition, it can be noticed that, for the first and the second rank, there was a difference in the score values at the excellently high level with the objective of Heuristics Strategies, stimulating for the design education to create an intellectual framework for solving problems further. Later, it can make the achievement motivation progressively [36-37], for predicting whether the students can apply heuristics strategies to have high opportunity for achievement in industrial design and product projects in the near future [38].

According to the achievement motivation, it becomes the important component for Heuristics Strategies with more effectiveness. Then, it can stimulate for gaining of brain development with full effectiveness including of pushing up to gain the high level of achievement motivation with academic achievement [39-42]. Then, it is regarded as the knowledge creation from the existing potential of the students to be the basic knowledge of theory and practice by stimulating to gain the action value and the management in a personal project. As the result, it can promote positive motivation in the academic field to the students with effectiveness [43-46].

Similarly, according to the student assessment with the confident feeling from the stimulation of the learning method with heuristic strategies, it was found that the confident values of the students in this method were at a higher level than the normal study learning as the teacher-centered. Thus, it has seen obviously that learning with heuristic strategies can build up confidence in the systemic thinking procedure for

solving the problems in their projects, and it is one part of the desirable characteristics of the design education students in Faculty of Industrial Education and Technology from King Mongkut's Institute of Technology Ladkrabang. Thus, the students should cope with the standard of the curriculum of design education, and when considering from the differences of confident scores in personal project ordering from the most level to the least level: 1) Management step with plan 2) Planning step with requirements 3) Satisfaction to learning pattern 4) Expression of intelligence 5) Searching problems 6) Correctness and the possibility to respond to problems and other issues [47-49].

In this case, the planning step and troubleshooting planning step with requirements showed a difference in the score value level at the exceptionally high level between the two learning groups. In this case, these two learning methods accounted for the main objective and a good feature of learning for heuristic strategies. With this case, it can create wisdom and new skills during this time, and the research results conform to the goals of heuristic strategies, including 1) Stimulation to have an efficient thinking procedure, and 2) having systemic thinking in order to be capable of creating knowledge for students in the long term [50-51], including aiding those who have troubleshooting decisions in design product for solving problems with effectiveness and planning [52-54].

5 Acknowledgements

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