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21st Century Learning: Experiential Learning to Enhance Critical Thinking in Vocational Education

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Abstract Vocational education aims to prepare students to work in certain fields. The profile of graduates of vocational education must have competencies relevant to 21st century competency. 21st century competency is oriented to critical thinking skills. Critical thinking ability is an important skill and must be possessed by students to face the challenges of the 21st century. Critical thinking skills accommodate learning activities that could improve high-level thinking skills (Higher Order Thinking Skills/HOTS). Therefore, learning management needs to be effective, efficient, and relevant to 21st century learning. Learning management aims to manage educational resources to create a learning atmosphere and learning process so that students are actively involved and could develop their potential. One method of learning that is able to engage students actively is experiential learning. Experiential learning uses the student-centered learning approach that starts with the premise that the best way to learn is from experience or learning by doing. The objective of this research was to develop learning design of 21st century learning based on experiential learning in the Basic Mechanical Engineering Design to enhance students' critical thinking skills in vocational education by considering student learning styles. Student learning style preferences were measured using the Felder-Solomon Learning Style Index. This article uses developmental research method by applying ADDIE model. Data was collected through observation, questionnaire, and interview. The results of the validation from the expert learning model showed a validation percentage of 91.48% which meant that the experiential learning model was very feasible to use, while the validation results from learning material experts showed an 88.75% validation percentage which meant the Basic Mechanical Engineering Design material was very appropriate. The initial response of students was positive towards experiential learning. That means students like to be actively involved in a series of experiential learning activities.

Keywords 21st Century Learning, Experiential, Critical Thinking, Mechanical Engineering, Vocational Education

1. Introduction

The first step in improving the quality of education begins with improving the management of education (Coombs, 1968). Management is an instrument of an educational unit to achieve goals. Education management is a field of study and an educational organization activity (Bush, 1995). The management of education is carried out through a series of activities in the form of a process of managing business ventures in educational organizations to achieve defined educational goals by utilizing existing resources to achieve goals effectively and efficiently. Usman (2004) stated that the elements of education management includes man, material, machine, money, method, market, and minute. One of the goals and benefits of education management is the realization of an atmosphere of learning and an active, innovative, creative, effective and enjoyable learning process.

Vocational education is secondary education that prepares students primarily to work in certain fields (Law Number 20 of 2003). Vocational education is specialized preparation for entry into employment or advance on the job (Evans, 1978; Wenrich, et al, 1988). However, the fact is that graduates of vocational education in this case from the Vocational High School couldn't only work in certain fields, but also could be self-employed and continue their studies to higher education. The essence of vocational education according to Prosser & Quigley (1950) is to teach the habit of thinking and working through direct practice carried out repeatedly. The habits that are taught include the habit of adapting to the work environment, habits in the process of carrying out work, and habits of thinking (in work).

The principles of vocational learning include: vocational learning will be efficient if the learning environment is a replica of the work environment and will be effective if it trains someone in the habit of thinking and working. Furthermore, it will be effective if the training experience is to shape work habits and correct thinking habits and efficient vocational learning if teaching methods are used and personal relationships with students consider the characteristics of students. Efforts to increase motivation, interest and understanding of student learning are by developing learning methods based on student learning styles that are in accordance with school conditions. Learning style is a way how a person receives and processes information in learning (Brown, 2000). Munif Chatib (2012) stated that the number of student failures in receiving information is due to the incompatibility of teacher teaching styles with student learning styles. This opinion is in accordance with Nasution (2003) which states that "each teaching method depends on the way or style of students learning, their personalities and their ability". Thus, teachers in teaching should pay attention to students' diverse learning styles. Based on the characteristics and principles of vocational education, the vocational education curriculum must be process oriented (in the form of learning experiences and activities in schools) and products (the results of learning experiences and activities). The ultimate goal of vocational education curriculum is not only measured through achievement in the form of values, but also through the results of these achievements in the form of performance (Finch & Crunkilton, 1999).

The vocational education curriculum in Indonesia is more oriented towards student potential to character education strengthening in the teaching and learning process (Minister of education and culture regulations Number 20 of 2018). The consequence of the 2013 curriculum implementation is that teachers are required to be more qualified in carrying out learning activities. The 2013 curriculum applies a scientific approach. In addition, it also optimizes the role of teachers in implementing 21st century learning and the ability to think critically which is often called Higher Order Thinking Skills (HOTS) (Minister of education and culture regulations Number 22 of 2016). According to Bialik & Fadel (2015), 21st century learning is defined as learning that provides 21st century skills and skills to students, namely 4Cs including communication skills (ability to communicate), collaboration (ability to work together), critical thinking and problem solving (critical thinking skills and solving problems), and creative and innovative skills(creative and innovative skills). Besides, there is also confidence (confidence). The 21st century skills are expected to be achieved by applying HOTS or high-level thinking skills.

Therefore, 2013 curriculum provides greater opportunities for teachers in the management of vocational learning, while demanding teachers to innovate overall learning, especially methods, approaches and learning models adapted to 21st century learning oriented to high-level thinking skills. Learning management aims to manage educational resources to realize the learning atmosphere (Kurniadin & Machali, 2012) and the learning process so that students are actively involved and can develop their potential. One method of learning that is able to engage students actively is experiential learning. Experiential learning is a learning process where knowledge is created through transformational experiences (Kolb, 1984). The cornerstone of experiential learning is the best way of learning based on experience (learning by doing) and student-centered learning. Development of learning management and learning engineering needs to be done to create a learning environment where students are more actively involved in the learning process, focusing on design problems and challenges as well as collaborating with other students to complete the given task (Pinder-Grover, 2013).

This article presents how the management or learning design of 21st century learning based on experiential learning is integrated into learning the basic concepts of mechanical engineering as a case study. The stages of experiential learning are explained by designing a series of learning activities in order to enhance critical thinking skills for vocational high school students in the Basic Mechanical Engineering Design subjects. Mastery of the Basic Concepts of Mechanical Engineering Design is a basic competency that students must possess as a provision of knowledge before exploring mechanical engineering. Experiential learning activities are designed to support the concept of student-centered learning and 21st century learning. 21st century learning management based on experiential learning aims to help students construct knowledge and is expected to improve students' understanding through hands-on learning experience.

2. Literature Review

Learning design 21st century learning based on experiential learning in the Basic Mechanical Engineering Design subjects is based on the Kolb's cycle which is adapted to 21st century learning in order to enhance students' critical thinking.

2.1. Experiential Learning

Experiential learning is defined as "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience" (Kolb, 1984). Kolb’s experiential learning (experience-based learning) theory provides a clear mechanism of teaching and learning design with a learning model that emphasizes the constructivist aspects of knowledge and skills through hands-on experience (Smith, 2001). Kolb stated that effective learning must go through four stages, namely concrete experience, reflective observation, abstract conception, and active experimentation.

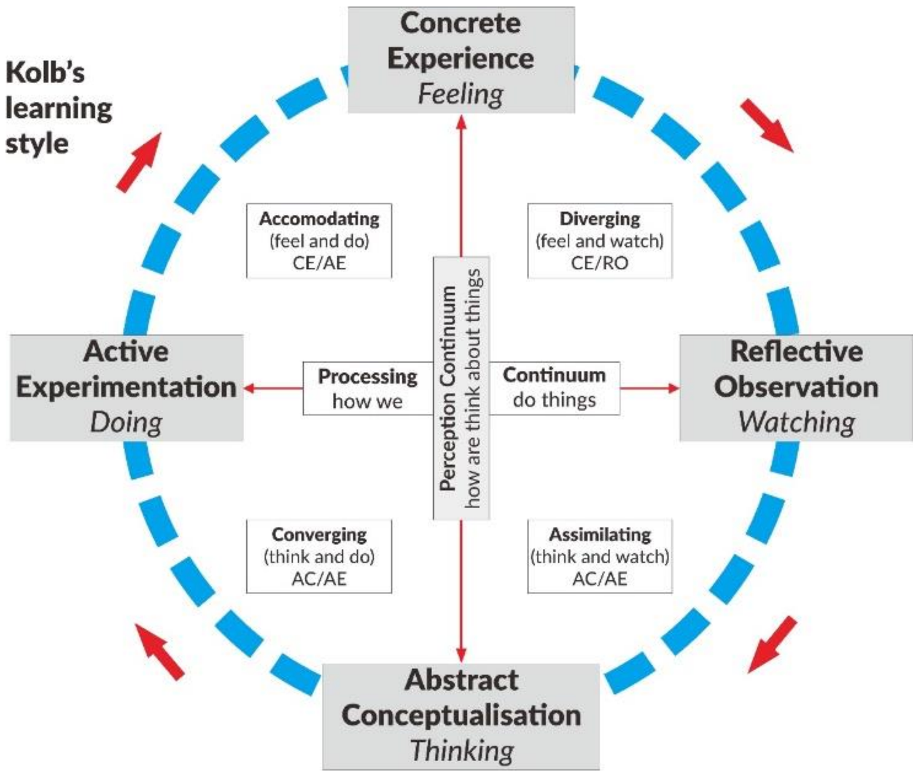


Figure 1. Kolb's cycle of Experiential learning (Pamungkas, et al, 2019)

Table 1. Classification of Felder-Silverman's Learning Style Dimensions

Numb.	Dimensions of Learning Style	Explanation
1	*Active*	Prefer to understand information by trying, doing practical activities and group learning.
2	*Reflective*	Prefer to learn by thinking of several things at once and learning on their own.
3	*Sensing*	Prefer to be oriented to clear facts, learn material that is concrete, practical, enjoy explanations with detailed details and solve problems using predetermined methods.
4	*Intuitive*	Prefer to be oriented to theory, learn material that is abstract, more innovative and creative, enjoy global explanations and like challenges.
5	*Visual*	Prefer to learn with visual materials such as pictures, diagrams, videos, flowcharts.
6	*Verbal*	Prefer to learn with verbal, oral or written words.
7	*Sequential*	Prefer to study linearly, use regular steps to achieve learning goals, and explore material sequentially.
8	*Global*	Prefer to study randomly, use a free approach that does not follow steps or procedures, and explore material in a non-sequential (holistic) manner.

2.2. Felder-Silverman Learning Style

Learning style is something that students have to process information into knowledge or a comfortable way that students do in the learning process. Felder-Silverman's learning style which is commonly known as Felder Silverman Learning Style Dimensions (FSLSM) is one of the learning style models proposed by Richard M. Felder and Linda K. Silverman (Felder & Silverman, 1988). Student learning styles are categorized into four dimensions, namely active-reflective, sensing-intuitive, visual-verbal, and sequential-global. Learning styles are known through measurement using the Learning Style Questionnaire, which was then disseminated with the collaboration of Richard M. Felder and Barbara A. Solomon at North Carolina State University.

2.3. 21st Century Learning

21st century learning contains 21st century competencies or skills which include ways of thinking, ways of working, tools of working, and living in the world (Griffin et al. al, 2012).

The 21st century is a century of the rapid development of science and technology. Development takes place in various sectors so that it requires humans to work with complex thinking and communication skills (Berry, 2010).

Critical thinking skills are one of the skills that are very important to overcome the demands of the 21st century with a tendency to make and make conclusions based on evidence (Eggen & Kauchak, 2012). Students who have critical thinking skills will try to provide logical reasons for understanding and connecting each thing. In addition, students have the ability to compile, analyse express and solve problems (Husamah & Setyaningrum, 2013). Critical thinking skills accommodate activities that could improve high-level thinking skills (Saputri, et al, 2018). Therefore, critical thinking skills through HOTS need to be accustomed and to be taught and trained for students in the process of vocational learning in schools. The aim is to provide students with high-level thinking skills for students to face the future and the demands of 21st century learning.

Based on the 21st century learning concept, implementation in formulating a 21st century learning framework in Indonesia is multidisciplinary. Based on the results of the study document Law Number 20 of 2003, *Nawacita*, and the National Medium-Term Development Plan for primary, secondary and higher education, two additional standards were obtained in accordance with government policy and curriculum policy, namely Strengthening Character Education on Character Development and Spiritual Value. This is contained in the Indonesian Partnership for 21 Century Skill Standard (IP-21CSS).

Figure 2. 21st century skills

Table 2. Framework for 21st Century Thinking Concepts in Indonesia (Arend, 2012)

Framework 21st Century Skills	**IP-21CSS**	**Aspect**
Creativity Thinking and innovation	4Cs	• Think creatively • Work creatively with others • Implement innovation
Critical Thinking and Problem Solving		• Effective reasoning • Use a thinking style • Make judgments and decisions • Solve the problem
Communication and Collaboration		• Communicate clearly • Collaborate with others
Information, Media and Technology Skills	ICTs	• Access and evaluate information • Use and organize information • Analyze and produce media • Apply technology effectively
Life & Career Skills	Character Building	• Demonstrate the scientific behavior of attitude (desire to be curious, honest, thorough, open and prudent) • Demonstrate acceptance of the moral values prevailing in society
	Spiritual Values	• Live the concept of God through science • Internalize spiritual values in everyday life

3. Research Method

The research method used was development research method (Richey & Klein, 2005). This study involved 49 participant of grade X vocational high school students in the mechanical engineering program who enrolled Basic Mechanical Engineering Design course. This research develops learning design based on experiential learning and considers student learning styles. The process of designing uses the stages of the ADDIE model development concept, namely analysis, design, development, implementation, and evaluation.

3.1. Analysis

The analysis phase was carried out by conducting field studies and literature studies to find out the needs in learning Basic Mechanical Engineering Design. The field study aims to obtain data or information about the learning process which includes the learning model used by the teacher as well as the constraints experienced during the learning process. While in the literature study phase aims to find information related to methods, strategies and approaches that will be developed into a learning model. Literature studies include the study of theories obtained from books, journal articles, and relevant research results. The needed analysis conducted includes an analysis related to the potential and characteristics of the learning process in Vocational Schools, an analysis of the curriculum, also an analysis of the characteristics of students' learning styles.

Student learning style preferences were measured using the Felder-Solomon Learning Style Index. The learning style questionnaire (ILS Questionnaire) consists of 44 items that the respondent must answer. ILS examines four dimensions of learning styles, namely processing (active-reflective), perception (sensing-intuitive), input (visual-verbal) and understanding (sequential-global). Every dimension of learning style has 11 question items. Each question item in the questionnaire consists of two answer choices.

3.2. Design

The design phase of experiential learning models which include the stages of establishing Basic Competence (BC), analyzing the relevance of Graduates Competency Standards (GCS), Core Competencies (CC) and Basic Competencies (BC), elaborating BC into Indicators of Competency Achievement (ICA), determining learning objectives based on ICA, determining learning material, and planning learning activities and assessments.

3.3. Development

The learning model development stage is carried out by making a product prototype. The product developed is a learning tool in the form of a syllabus, lesson plan, and student worksheets based on experiential learning by considering student learning styles. Learning tools contain material on basic competencies regarding the basic concepts of mechanical engineering design, namely moments. Learning activities represent Kolb's experiential learning cycle on these basic competencies. Kolb's experiential learning cycle includes concrete experience, reflective observation, abstract conceptualization, and active experimentation.

Product validation includes the validation of the feasibility of experiential learning design conducted by model experts and learning material experts. The results of the expert validation will show how feasible the experiential learning design is implemented in the learning process of Basic Mechanical Engineering Design. Design revision is an improvement stage in experiential learning design based on the results of validation by experts. Revisions are made if the experiential learning design requires improvement.

3.4. Implementation

The implementation phase is carried out by applying experiential learning design. The implementation is carried out by field trials to test the experiential learning design that has been developed. Field trials are carried out with a one-shot case study design, where experiential learning designs are implemented and then the results are observed and analyzed. Field trials are conducted to find out how to implement experiential learning design in the learning process of Basic Mechanical Engineering Design.

3.5. Evaluation

The evaluation phase is carried out by collecting data and processing data which then analyzes the data obtained from observation, questionnaires, and interviews. Then, the data is analyzed with qualitative descriptive analysis. Furthermore, the data is correlated with Kolb's experiential learning concept and the characteristics of each student's learning style. The evaluation phase is not only carried out at the final stage but is carried out at each stage of development. Evaluation results are used as benchmarks or reference for the feasibility of experiential learning design products using student worksheets by considering the characteristics of student learning styles to be implemented in learning the basics of Mechanical Engineering Design.

4. Findings and Discussion

Management of 21st century learning based on experiential learning is designed to be effective in the majority of the preference in student learning styles. The learning model consists of learning activities regarding the basic concepts of mechanical engineering design, namely moment and balance. The stages of learning management based on experiential learning are shown in the design of learning using 4Cs by considering learning styles.

In the Basic Engineering Design subjects, students are expected to be able to improve their high-level thinking skill. Learning activities represent the Kolb's experiential learning cycle including concrete experience, reflective observation, abstract conceptualization, and active experimentation.

4.1. Analysis

This study involved 49 respondents of grade X students to fill out the learning style questionnaire. The respondents were vocational high school students in the mechanical engineering program in Semarang, Central Java, Indonesia. Based on gender consisted of 47 male and 2 female students. The average age of respondents in grade X is 16.75 years.

The learning style questionnaire aims to determine the preference of learning styles that are dominant in grade X students in the mechanical engineering program. Based on the results of questionnaire data, processing obtained data that the preference of student learning styles is active, sensing, visual, and global. Table 3 shows data on the preference for learning styles of grade X students to be active (93.88%), followed by visual learning styles (77.55%), sensing (73.47%), and global (53.06%).

The Felder-Solomon Learning Style Index categorizes the preference for learning styles to be three levels, namely strong, moderate, and balanced. Data on preference in learning styles of mechanical engineering students are then categorized based on the level of strength shown in Table 4.

For active-reflective dimensions, students have a preference for active learning styles (93.88%) rather than reflective (6.12%). The type of active learning is the type of learning with the highest percentage compared with other types of learning for students majoring in mechanical engineering. In other words, there are 46 students who have a preference to learn actively. Most students are at a balanced level (42.85%) and moderate (40.81%), and only 10.20% at the strong level. In the sensing-intuitive dimension, the preference of students for sensing learning styles accounts for 73.47% and the remaining 26.53% were students with intuitive learning styles. In this dimension, 40.82% of students are at the moderate level and 28.57% at the balanced level, while the strong level is only 4.08%. Next for the visual type learning style there are 77.55% of students rather than verbal 22.45%. This shows that students are more likely to have the type of visual learning with the majority of students being at the moderate level of 36.73% and 28.57% at balanced level, while only 12.25% at the strong level. Interesting student learning styles are for sequential-global dimensions, although students overall tend to be of the global type (53.06%) rather than sequential (46.94%), but the difference in the preference percentage for this dimension is in the range of 6%. The largest percentage of sequential and global type students is at a balanced strength level, which is 46.93% for global type and 26.53% for sequential type, while moderate level is 6.13% for global type and 16.32% for sequential type, at the strong level only 4.09% for the sequential type only.

Table 3. Student Learning Style Preference

Grade	Active	Reflective	Sensing	Intuitive	Visual	Verbal	Sequential	Global
X	46	3	36	13	38	11	23	26
	(93.88%)	*(6.12%)*	*(73.47%)*	*(26.53%)*	*(77.55%)*	*(22.45%)*	*(46.94%)*	*(53.06%)*

Table 4. Distribution and Strength of Learning Style Preference

Learning Style / Strength Level	Balanced		Moderate		Strong		Total	
Active	**21**	**42.85%**	20	40.81%	5	10.20%	46	93.88%
Reflective	3	6.12%	0	0.00%	0	0.00%	3	6.12%
Sensing	14	28.57%	**20**	**40.82%**	2	4.08%	36	73.47%
Intuitive	12	24.48%	1	2.05%	0	0.00%	13	26.53%
Visual	14	28.57%	**18**	**36.73%**	6	12.25%	38	77.55%
Verbal	11	22.45%	0	0.00%	0	0.00%	11	22.45%
Sequential	13	26.53%	8	16.32%	2	4.09%	23	46.94%
Global	**23**	**46.93%**	3	6.13%	0	0.00%	26	53.06%

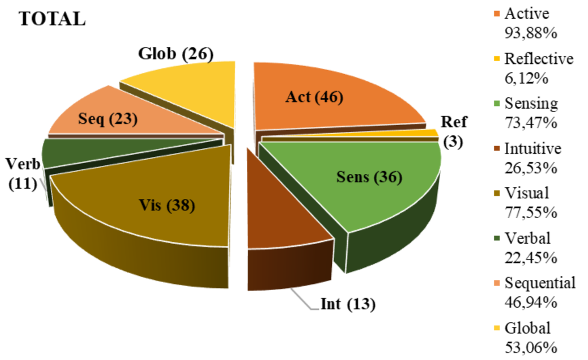


Figure 3. Total of student learning style percentage

Figure 3 shows the overall percentage of trends in student learning styles. Based on the diagram shows that overall the X grade students in the mechanical engineering program at the level of balanced, moderate, and strong have a preference for learning styles with the highest percentage of active as much as 93.88% or as many as 46 students, then visual 77.55% or as many as 38 students, sensing 73.47% or as many as 36 students, and global 53.06% or as many as 26 students. That means in general the students X grade of the mechanical engineering department in Semarang Regency were more likely to have active learning styles than reflective, sensing rather than intuitive, visual rather than verbal, and global rather than sequential. Therefore, by knowing the preference of student learning styles, the learning concepts for students could be designed in such a way according to the type of learning. The concept or design of learning activities will be more effective if it is in accordance with the learning style that is owned by the majority of students in a class.

Table 5. Description of the Preference of Student Learning Style

Learning Style	Preference
Active	Prefer learning by trying, doing practical activities, learning in groups, explaining to other friends, and discussion.
Sensing	Prefer things that are facts (concrete material), practical things, enjoy explanations with detailed details, solve problems using predetermined methods, tend to be careful in learning and love memorization.
Visual	Prefer learning material that is explained visually with many images, diagrams, videos, and flowcharts.
Global	Prefer the stages of learning in outline and randomly achieve learning goals and explore material randomly in completing learning tasks.

Table 6. Linkage Analysis of Graduates' Competency Standards, Core Competency, and Basic Competency

Graduate competence standard	Core Competency (CC)	Basic Competency (BC)	Linkage Analysis	Exp.
Skill Dimensions Having think and acting skills that are effective and creative in the abstract and concrete realm as the development of what is learned in school independently.	Carry out specific tasks by using tools, information, and work procedures which is commonly done as well solve the problem accordingly with the basic work of Mechanical Engineering.	Calculating the moment on a construction	*BC-1. P5 Calculate* (has been tested for CC-4)	Already corresponding
Knowledge Dimensions Having factual, conceptual, procedural, and metacognitive knowledge in science, technology, art, and culture with humanity, nationality, state, and civilization insights related to causes, as well as the impact of phenomena and events.	Understand, apply, analyze, and evaluate factual knowledge, conceptual, operational basis, and metacognitive in accordance with the fields and scope of work of the Basics of Mechanical Engineering.	Analyze the system moment on a construction	*BC-1 C4 Analyzes (already in accordance with CC-3 demands)* *BC-1 Analyzes have met the rules and have achieved C4 Knowledge Cognitive Domain as required by CC 3.*	Already corresponding

4.2. Design

Determination of BC is done by means of discussion between researchers, teachers and lecturer. The results of the discussion are determined as basic competencies which are then used to analyze the interrelationship of GCS, CC, BC, ICA, learning objectives, learning materials and assessment planning.

In addition, the results of the analysis of the characteristics of the majority of student learning styles become a material consideration in determining experiential learning design. Based on the results of curriculum analysis, the determination of BC, and analysis of learning styles, experiential learning design is then determined by the design and development of student worksheets in the Basic Mechanical Engineering Design subject on the basic competencies:

Table 7. Determined Basic Competence

BC (Cognitive)	BC (Psychomotor)
Analyzing the moment system in a construction.	Count moments in a construction.

4.3. Development

The learning model development stage is carried out by making a product prototype. Learning activities represent Kolb's experiential learning cycle on these basic competencies. Kolb's experiential learning cycle includes concrete experience, reflective observation, abstract conceptualization, and active experimentation.

The results of the validation of the learning model experts from the component aspects of learning devices using experiential learning design show that learning with experiential learning design is very feasible to use in the implementation of learning with a percentage of 91.48%. Based on the data validation, results of learning material experts who judge from the basic aspects of the consideration of the selection of experiential learning design included the very feasible category with a percentage of 87.50%, and aspects of the learning system components with experiential design included the very feasible category with a percentage of 90.00%. The average assessment of learning model experts is included in the very feasible category with a percentage of 88.75%. The results of the validation of learning material experts from the basic aspects of design selection considerations and the learning system component aspects show that learning with experiential learning design is very feasible to use in learning implementation.

Table 8. Learning activities based on experiential learning on topic of moment and balance

Stages	Activities
Concrete Experience (Feeling)	• Analyze the basic concepts of moments and couplings in internal thread making activities (tapping) • Analyze the principle of the moment and coupling through the nut tightening case and the case for lifting the cast iron • Analyze cases when someone drives a car • Analyze cases of pumping processes
Reflective Observation (Watching)	• Conduct observations or observations of objects and activities around which are related to moments and couplings so that they can explain the results of observations • Analyze and observe images related to the moment principle and coupling in the nut tightening process • Analyze and observe the process of driving a car (turning the steering wheel of a car) • Analyze and observe the style of action and reaction in the pumping process • Describe and analyze the capture and resultant points • • (Stimulate students to try to express opinions about moments and couplings)
Abstract Conceptualisation (Thinking)	• Describe moments and couplings based on observations • Describe and analyze the phenomena of nut tightening cases and how to lift cast iron • (Why it can be happened?) • Formulate moment equations and couplings through existing case examples
Active Experimentation (Doing)	• Carry out the tightening process of nuts or bolts • Conduct a tapping or cleaning process • Calculate the moment in the case of bolt tightening • Calculate the size of the coupling in the case of the cleaning process (outer screw making) • Calculate the moment for the case of turning the steering wheel • Calculate the action force and reaction of piston rods on the pump
After completing the learning process, students could fill in the learning experience sheets.	

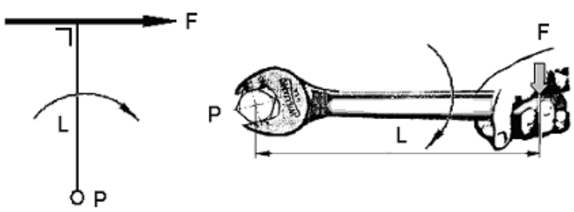
Table 9. Experiential Learning-Based Learning Design uses 4Cs

Knowledge	**Basic Design of Mechanical Engineering** **Analyze the moment system on a construction**
4Cs	**Indicators of Competence Achievement**
Creativity	Individually, students observe, repeat, refine, and present the results of the experiment which are contained in the student worksheet.
Critical Thinking	Students explore knowledge about moments and balance by discussing in groups.
Communication	Each group is invited to present the results of the discussion and the other groups give a response.
Collaboration	Students in groups discuss the moment and balance and conclude together all the material discussed.
Skills	**Basic Design of Mechanical Engineering** Calculate the moment on a construction
Creativity	Learners carry out the process of tightening the nuts and bolts and the tapping process by paying attention to the principle of the moment that works in the process.
Critical Thinking	In groups, students fill the student worksheet to analyse, compare, and connect moments and balance to events in the surrounding environment or machining work.
Communication	Randomly the students were asked to tell and present the results of the experiment and the results of the analysis of the nut tightening process and the tapping process.
Collaboration	Students present the results of the analysis in groups by working together and curiosity.

Examples of learning activities about moments

Case 1. Basic Principles of Moments through Nut Lift

In the field of engineering there are many tools that can be used to relieve or assist work, such as opening nuts or bolts. The way to open the nut or bolt is to rotate it.



- What if turning the nuts is done empty handed?
- How to make it easy to tighten or loosen the nuts?
- Are there differences in the use of short-stemmed and long-stemmed keys?
- If there is, what is the difference? And why can it be different?

4.4. Implementation and Evaluation

The learning designed of experiential learning was then implemented in the classroom. After that, the students were asked to complete questionnaires and interviewed. The questionnaires were then used to measure students' responses in learning process. Based on the analysis of completed questionnaires, we had mean score of students' responses of 4.23 or 84.6%. It showed that the students had positive responses to the experiential learning process. The positive responses showed that experiential learning design was effective and valid.

To observe learning process such a checklist observation form was used. An accompanying observer was asked to observe teacher and students then completed the checklist observation form. Overall, the percentage of observations of the implementation of experiential learning design in Basic Mechanical Engineering Design subject learning using student worksheets was 92.09%. This shows that experiential learning activities are carried out very well.

5. Conclusions

This article describes management or learning design of 21st century learning based on experiential learning by considering student learning styles to enhance critical thinking skills of vocational high school students. Learning is designed for the Basic Mechanical Engineering Design subjects on the topic of the moment. Kolb's stage of experiential learning is used as a basis by considering the preference of student learning styles. In addition, it also accommodates skills or competencies in 21st century learning known as 4Cs, namely creativity, critical thinking, communication, and collaboration. The purpose of this learning management is to help students construct knowledge and skills so that they are expected to be able to improve higher order thinking skills (HOTS) through learning experiences directly in accordance with their learning styles. Learning activities represent concrete experience, reflective observation, abstract conceptualization, and active experimentation stages. The preference for learning styles of students in grade X majoring in mechanical engineering is 87.41%, then visual 84.44%, sensing 81.48%, and sequential 57.04%. The results of the validation of the learning model experts from the component aspects of learning devices using experiential learning design show that learning with experiential learning design is very feasible to use in the implementation of learning with a percentage of 91.48%. Based on the data validation, results of learning material experts who judge from the basic aspects of the consideration of the selection of experiential learning design include the very feasible category with a percentage of 87.50%, and aspects of the learning system components with experiential design include the very feasible category with a percentage of 90.00%. The average assessment of learning model experts is included in the very feasible category with a percentage of 88.75%. The results of the validation of learning material experts from the basic aspects of design selection considerations and the learning system component aspects show that learning with experiential learning design is very feasible to use in learning implementation. The initial response of students was positive towards experiential learning. That means students like to be actively involved in a series of experiential learning activities. The future study is conducted to evaluate the implementation of 21st century learning design based on experiential learning in vocational education.

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