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Project-Based Learning at Vocational Schools: A Case Study of the Implementation of Entrepreneurship Learning Model

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Learning models with integrated systems should be applied to learning activities in schools to ease students understand the interrelationships between various subjects. This study aims to determine: (1) student learning achievement by applying Entrepreneurship Learning Model based on Construction Building Project; (2) the level of Entrepreneurship Learning Model application; (3) the level of quality of simple home design planning in learning using Entrepreneurship Learning Model; (4) the level of quality of the final product of simple home designs in learning using Entrepreneurship Learning Model. This research is a quasi-experimental study with a sample of students at Vocational High School. To validate the instrument, this study used expert judgment; to validate the reliability of the instrument this study used the Cronbach alpha technique; to test the statistical difference, this study used the t-test; and to analyze the data, this study used descriptive analysis. The results of this study are: (1) student achievement in learning process using Entrepreneurship Learning Model is better than student achievement in learning process using Lecture Method; (2) the level of application of Entrepreneurship Learning Model is in good category according to students' assessment and is in very good category according to teacher's assessment; (3) the quality of simple house design planning is in good category according to industry assessment and teachers' assessment; (4) the level of quality of the final product of simple house designs is considered very good according to teachers.

Keywords: vocational high school (VHS), entrepreneurship learning model, construction building project, learning, project-based learning,

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INTRODUCTION

In developing countries, unemployment can trigger many things, from a loss of self-esteem, shaping passive societies, crime and drug abuse, suicidal intentions, to deteriorating global economy (Van der Meer & Wielers, 2016; Mohamed, 2019; Lim & Lee, 2019; Mubarak & SBM, 2020). According to the Central Statistics Agency of the Republic of Indonesia (2020), open unemployment number in Indonesia reached 137.91 million in February 2020. This figure increased by 1.73 million compared to the same period in the previous year. The increase in the unemployment number was dominated by Vocational High School (VHS) graduates by 8.49% (Widodo et al., 2020). High unemployment rate can be caused by several factors, including: (1) very selective job market in determining the criteria for prospective workers, (2) the imbalance between supply and demand, (3) the gap between expectations and reality faced by graduates, and (4) the inability of graduates to meet the standards of skills and abilities required by job market (Hwang, 2017; Faisal & Martin, 2019).

Vocational school is a secondary formal education level as a continuation of junior high school education or its equivalent. In Indonesia, the implementation of vocational schools aims to produce work-ready graduates according to competence in their fields. However, nowadays the aim of organizing vocational schools is not only to prepare graduates to be ready for work but also to equip prospective graduates to continue their studies and become entrepreneurs. In connection with entrepreneurship, this ability can actually be trained through entrepreneurship learning.

Entrepreneurial learning is defined as a process in which a person acquires, assimilate, and organizes newly formed knowledge with a pre-existing structure, and how it influences entrepreneurial action (Tambunan et al., 2021). On the other hand, education learns students to recognize opportunities, take advantage of them then use what they have started to start, manage, and operate their businesses (Zhang et al., 2020). Entrepreneurial learning is an action that helps in increasing the basic knowledge base that is useful in running and starting a new business (Rive et al., 2017). Thus entrepreneurship learning can be said as part of an educational program that trains students to have competencies in accordance with the knowledge development needed to be effective in running and managing new businesses.

The results of the study show that there are five values that need to be given to entrepreneurship subjects, namely: entrepreneurial mentality; innovation; looking for business ideas/ideas; face risks; and marketing (Rinawiyanti, 2017). In line with this, vocational schools should instill entrepreneurial values in prospective graduates which include values of faith and devotion, disciplinary values, honesty values, prestige values of work behavior which includes sincere work, smart work, emotional self-awareness, hard work and thoroughness. work, creativity and innovation, self-confidence and responsibility (Supriyatiningsih, 2012). Where entrepreneurship learning is expected to be able to actualize the concept of entrepreneurship, practice business development, gain practical experience in entrepreneurship, foster an interest in entrepreneurship and develop the potential for an entrepreneurial spirit in students. Therefore, learning entrepreneurship in schools must be an alternative in preparing vocational graduates

who are able to create jobs and be able to adapt to social life. The implementation of entrepreneurship education in vocational high schools can be carried out through one subject or integrated into other subjects (Venesaar, 2021).

In current situation, to make students ready to compete in job market once they graduate, learning activities in schools or internships in industry are implemented. However, learning activities in schools should meet competencies or skills needed in the industries. Currently, moreover, vocational high school graduates are not only expected to be ready to work, but also capable of building their own businesses (becoming entrepreneurs). One subject in vocational high school that contributes to growing and training students' entrepreneurial spirit is Creative Products and Entrepreneurship (CPE), which currently gets attention (Ministry of Education and Culture, 2018). CPE subject is focused on businesses development through a formation of mindset and development of practical skills to start new businesses, supported by creativity, curiosity, willingness to apply knowledge and skills that lead to innovation and creation of new businesses (Neck & Corbett, 2018; Wenninger, 2019). Therefore, learning in vocational high school must be carried out using a suitable learning model and with integration with other related subjects.

According to the Regulation of the Minister of Education and Culture Number 65 of 2013 concerning Process Standards, one of learning models that is prioritized in learning CPE is Project Based Learning (PjBL). The objectives of PjBL are: (1) to help students gain deeper knowledge, (2) to develop students' psychomotor and social skills, (3) to help students commit to the learning process, (4) to make students more active in their projects, and (5) to increase student collaboration in study groups (Syukriah, Nurmaliah, & Abdullah, 2019; Syakur et al., 2020; Santyasa, Rapi, & Windu, 2020; Han et al., 2015; Aldabbus, 2018; Kokotsaki, Menzies & Wiggins, 2016).

Based on the explanation above, this study will present a review of the Implementation of Entrepreneurship Learning Model based on Construction Building Project which is integrated into Creative Products and Entrepreneurship (CPE), Software Applications (SA), and Construction Cost Estimation (ECC) subjects in Vocational High Schools majoring in Modeling Design and Building Information. This study will show that Entrepreneurship Learning Model based on Construction Building Project can be integrated with related subjects and can become a significant positive factor on student learning achievement. The results of this study will answer research questions: (1) the level of student achievement in learning that uses the entrepreneurship learning model; (2) The level of application of the understanding learning model according to the assessment of the students and according to the teacher's assessment; (3) the quality level of home design planning based on industry assessment and according to the teacher; (4) the quality level of the final home design product which is considered very good according to industry assessments and according to teachers.

Literature Review

Project-Based Learning (PjBL)

One variation of integrated learning models that can be applied to learning in vocational high school is Project Based Learning (PjBL) (Triana, Anggraito, & Ridlo, 2020). PjBL

model refers to an inquiry-based learning method and involves active roles of students in learning to finish a project (Guo, Saab, Post, & Admiraal, 2020). This model is suitable to be applied to learning processes in vocational high school to improve student learning outcomes, because students are led to explore, assess, interpret, synthesize, and provide information to complete real projects (Mafruudloh & Fitriati; 2020; Kızapan, 2017; Mailok, Ubaidullah, & Ahmad, 2016). Therefore, it is necessary to conduct various experimental studies to determine the benefits and effects of PjBL on student learning outcomes (Guo, Saab, Post, & Admiraal, 2020).

PjBL is designed through investigative activities to create realistic projects (Botha, 2010). The principles of PjBL are: (1) projects produce authentic products needed by industries; (2) students are conditioned to ask in-depth questions (rich inquiry); (3) students are trained independently (students' autonomy); (4) a collaborative environment must be created among students, between teachers and students, and between business actors and teachers; (5) the project must be oriented towards physical skills to produce real products (craftmanship); and (6) a meaningful assessments of the actual project results must be in accordance with the requirements/standards applicable in industries (Perkins, 2018; and Hahn, 2017). The stages of PjBL include: (1) determining basic questions (starting with essential questions), (2) preparing a project plan (project design), (3) making a schedule, (4) monitoring students and project progress, (5) assessing the results or outcomes, and (6) evaluating student experiences (Ministry of Education and Culture, 2014)

PjBL possibly integrates several subjects with the same characteristics into one project. Brassler & Dettmers (2017) and Shen, Sung & Zhang (2015) state that the integration involves students' emancipation and self-reflection, encourages critical thinking, solves complex cross-disciplinary problems, builds interdisciplinary communication, creates interdisciplinary collaboration processes and teamwork, and uses integrative potentials to create innovation. Seethamraju & Leonard (2006) and Bacon (2018) state that integrated learning is a process of bringing together many students' scientific disciplines, which focuses on the integration of several basic competencies or between two or more disciplines. In this process, apparently, there will be some challenges. These challenges include: (1) teachers must work based on standards according to curriculum mandate; (2) all students must be at the same level; and (3) limited teacher collaboration time (Hwang et al., 2020).

Teachers and students generally view the integration process as positive, approachable, and necessary to support student recognition in their learning discourse (Calvo et al., 2020). The pattern of integration according to the Ministry of National Education (2010) consists of (1) all subjects, (2) learning changes, (3) extracurricular activities, (4) self-development, (5) school culture, and (6) local content. There are two integration models, namely (1) Connected Model, and (2) Nested Model (Drake (2007).

The implementation of the Connected Model and Nested Model can produce products, such as company products, which reflect the core of vocational education in schools (Zhiqin, 2020). The emphasis is on soft skills and hard skills. Students will have the ability to significantly improve performance, create a future job profile, and become the

industry's most desired professional candidate (Patacsil, Lourrine, & Tablatin, 2017; Torun, 2018; Sopa et al., 2020). In this study, the integrated subjects are: (1) Creative Products and Entrepreneurship (CPE), (2) Software Applications (SA), and (3) Construction Cost Estimation (ECC). To ease calling this integration, we will call this CPE-SA-ECC Integrated Subject.

Entrepreneurship Learning Model based on Construction Building Projects

Integrated learning is related to three things: (1) overcoming tension, (2) focusing on teacher teaching methods, (3) connecting pedagogical aspects (Kerkhoffa & Cloud, 2020). Integration provides opportunities for students to master knowledge through communication and collaboration (Kundu, A. & Bej, T., 2020). Integrated learning in CPE, SA, and ECC subjects in vocational high school is in the form of knowledge and skill construction produces entrepreneurial products. Entrepreneurship Learning Model based on Construction Building Project was developed from PjBL model and the Deming Plan-Do-Check-Action/Revision cycle model (Sutarto, Hariyanto & Pratama, 2018; Patel & Deshpande, 2017). Integration is carried out in Modeling Design and Building Information Major in vocational high school (Ministry of Education and Culture, 2017). The scheme of Entrepreneurship Learning Model based on Construction Building Project in the learning processes of CPE-SA-ECC Integrated Subject can be seen in Figure 1 below.

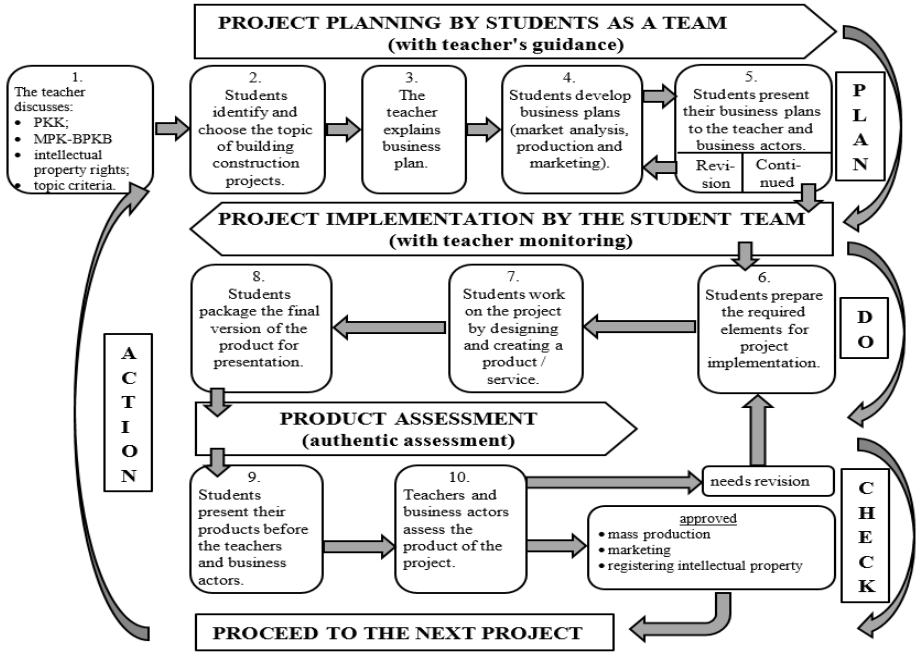

Figure 1
Entrepreneurship learning model based on construction building project

METHOD

Design

This study was quasi-experimental, meaning that in this study there was an Experiment Group and a Control Group that were chosen randomly. Both groups will be given a pretest, treatment, and posttest. Pretest was given to the Experiment Group and the Control Group before the treatment was carried out. The Experiment Group received learning treatment using Entrepreneurship Learning Model based on Construction Building Project in CPE-SA-ECC Integrated Subject, while the Control Group was taught using conventional lecture methods in the Integrated Subject. Schematically, the research design can be seen in Figure 2 below.

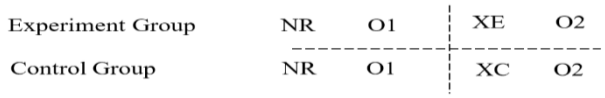

Figure 2
Research design (Campbell & Stanley, 1963; Hastjarjo, 2019)
Description:
NR : Non-Random
O1 : Pretest with CPE-SA-ECC materials
XE : Treatment with Entrepreneurship Learning Model based on Construction Building Project
XC : Conventional learning with lecture method
O2 : Posttest with CPE-SA-ECC materials

Participants

This research involved two vocational high school which were geographically far apart. This was done to minimize the impact of some aspects of internal validity and external validity in this experimental research (Campbell & Stanley, 1963). The Experiment Group was the 11th grade students majoring in Modeling Design and Building Information at State Vocational High School 2 Depok, Sleman, Indonesia; while the Control Group was the 11th grade students majoring in Modeling Design and Building Information at State Vocational High School 1 Seyegan, Sleman, Indonesia. The study was conducted for 8 meetings on each group (experimental and control).

The population of the study was 93 students of 11th grade majoring in Modeling Design and Building Information of two vocational high school. The details of the population can be seen in table 1 below.

Table 1
Research population

No	VHS	Class	Major	Number of Students
1	State Vocational High School 2 Depok, Sleman	XI	Modeling Design and Building Information	30
2	State Vocational High School 1 Seyegan, Sleman	XI	Modeling Design and Building Information A-1	33
		XI	Modeling Design and Building Information A-2	30
TOTAL				93

Based on table 1, there are 3 classes majoring in Modeling Design and Building Information in these two vocational high schools. From the three, two classes were randomly taken as sample. One class was used as an Experiment Group, where students were given learning treatment with Entrepreneurship Learning Model based on Construction Building Project, while another class was given conventional learning using the lecture method. Therefore, there were 30 11th grade students of State Vocational High School 2 Depok, Sleman for the Experiment Group, and 30 11th grade students of State Vocational High School 1 Seyegan, Sleman for the Control Group.

Data Collection Technique and Research Instrument

The Achievement of Student Study

Measurement of student learning achievement in the CPE-SA-ECC Integrated Subject using Entrepreneurship Learning Model based on Construction Building Project or using the lecture method was carried out using a pretest and posttest in Experiment Group and Control Group. The pretest and posttest indicators can be seen in table 2 and table 3.

Table 2
Pretest instrument indicators

No	Subjects	Indicator	Item number
1	Creative Products and Entrepreneurship (CPE)	1. Entrepreneurship attitude	1; 2; 3;
		2. SWOT analysis	4; 5;
		3. Product planning	6; 7; 8;
		4. Product price assessment	9; 10;
2	Software Application (SA)	1. AUTOCAD application	11; 12;
		2. Materials for interior design	13; 14; 15;
		3. Simple home design	16; 17; 18;
		4. The basic principle of making building miniatures	19; 20;
3	Construction Cost Estimation (ECC)	1. Stages of making a simple house	21; 22; 23;
		2. Analysis of the unit price of the work	24; 25;
		3. Calculation of the building cost budget plan	26; 27; 28;
		4. The basic principle of unit volume calculation	29; 30.

Table 3
Posttest instrument indicators

No	Subjects	Indicator	Item number
1	Creative Products and Entrepreneurship (CPE)	1. Attitude in thinking rationally	1; 2; 3;
		2. Intellectual Property Rights (IPR)	4; 5;
		3. Product packaging	6; 7; 8;
		4. The basic principle of product marketing	9; 10;
2	Software Application (SA)	1. Variation of building elements of a building sketch	11; 12;
		2. Finishing elements of the building architecture	13; 14; 15;
		3. The perspective of drawing	16; 17; 18;
		4. Variation of building mockup accessories	19; 20;
3	Construction Cost Estimation (ECC)	1. Work Plan and Requirements	21; 22; 23;
		2. Contract documents	24; 25;
		3. Estimated time of building construction work	26; 27; 28;
		4. Estimated cost of a simple house	29; 30.

Students' Perception of the Application of Entrepreneurial Learning Model based on Construction Building Project

Indicators for assessing students' perception of the implementation of Entrepreneurship Learning Model based on Construction Building Project can be seen in table 4.

Table 4
Indicators of students' perception assessment of the application of entrepreneurship learning model based on construction building project

No	Indicators
1	Teacher's explanation regarding the objectives and scope of the learning materials
2	Teacher's explanation of the concepts, values and stages of the Entrepreneurship Learning Model Based on Building Construction Projects
3	Teacher's explanation regarding the meaning, purpose and stages of filing IPR
4	Teacher's explanation of the project topic selection criteria
5	Teacher's explanation of the uses and components contained in the business plan
6	Teacher's explanation of the assessment criteria and how to present the business plan
7	Teacher's explanation of the things that need to be prepared in project implementation
8	Teacher's explanation of how to work on the project (to produce products/services designed by students)
9	Teacher's explanation regarding the packaging of the project's final product for presentation
10	Teacher's explanation of the evaluation criteria for the final product of the project

The way to answer the instrument for assessing students' perception of the implementation of Entrepreneurship Learning Model based on Construction Building Project is to choose one answer that is considered suitable to the respondents. Alternative options are Likert scale, 5 = very well implemented; 4 = well implemented; 3 = fairly well implemented; 2 = Poorly implemented and 1 = Not implemented. The analysis of the interpretation of students' perception of Entrepreneurship Learning Model based on Construction Building Project can be seen in table 5.

Table 5
Interpretation of the assessment of students' perception of the application of entrepreneurship learning model based on construction building project

Interval	Score Conversion to 100	Category
$X \geq 42.02$	$X \geq 80.00$	Very Good
$34.02 \leq X < 42.01$	$60.00 \leq X < 80.00$	Good
$25.98 \leq X < 34.02$	$40.00 \leq X < 60.00$	Fairly good
$17.99 \leq X < 25.98$	$20.00 \leq X < 40.00$	Poor
$X < 17.99$	$X < 20.00$	Not Executed

Teachers' Perception of the Application of Entrepreneurial Learning Model based on Construction Building Project

The assessment of teachers' perception of the implementation of Entrepreneurship Learning Model based on Construction Building Project can be seen in table 6.

Table 6
Teachers' perception assessment indicators of the application of entrepreneurship learning model based on construction building project

No	Indicator
1	students identify topics needed by construction building business actors
2	students determine the topic of the project
3	students develop a business plan (market analysis, production, capital, and marketing)
4	students present their business plans in front of teachers and business actors
5	in groups, students prepare the necessary project needs
6	in groups, students work on projects to produce products/services
7	in groups, students pack the final product of the project to be presented
8	in groups, students present project products in front of teachers & business people
9	in groups, students improve project products if they do not meet the assessment criteria

The way to answer teachers' perception assessment instrument of the application of Entrepreneurship Learning Model based on Construction Building Project is to choose one answer that is considered suitable to the respondents. Alternative options are Likert scale, 5 = very well implemented; 4 = well implemented; 3 = fairly well implemented; 2 = Poorly implemented and 1 = Not implemented. The analysis of the interpretation of teachers' perception of the implementation of Entrepreneurship Learning Model based on Construction Building Project can be seen in table 7.

Table 7
Interpretation of teachers' perception of the application of entrepreneurial learning model based on construction building project

Interval	Score Conversion to 100	Category
$X \geq 37{,}80$	$X \geq 80.00$	Very Good
$30{,}60 \leq X < 37{,}80$	$60.00 \leq X < 80.00$	Good
$23.40 \leq X < 30.60$	$40.00 \leq X < 60.00$	Fairly good
$16.20 \leq X < 23{,}40$	$20.00 \leq X < 40.00$	Poor
$X < 17.99$	$X < 20.00$	Not Executed

Assessment of business product planning – making simple house type designs

At the last meeting of the learning in Experiment Class, students were given a task to plan simple house designs. Simple house – type 36 m² for group I, type 45 m² for group II, type 56 m² for group III and type 60 m² for group IV. The criteria for assessing business product plan of simple home designs can be seen in table 8.

Table 8
Indicators for assessing the criteria of project planning of simple home design business product

No	Criteria	Sub Criteria
1	floor plan	clarity of order in floor plans
		clarity of material notation on floor plans
		the clarity of the floor height of the room and
		the suitability of the image scale with the size of the paper used
2	pieces, front view and side view	the suitability of the secant line with the resulting sketch
		placement of size/information on the sketch
		visible conformity with the cut-out sketch and
		clarity of material notation on sketch
3	roof plan	clarity of the roof line
		the correct size of the roof truss construction
		clarity of material notation on the roof truss and
		completeness of roof construction sketch
4	materials used	the accuracy of the use of materials in the construction section
		dimensional accuracy of materials in construction building
		variations in the use of materials in construction building and
		the building materials used are easy to find
5	cost estimate	accuracy of building area calculation
		the suitability of the area with the price of the building offered
		the opportunity to sell the building at the estimated price, and
		the profitable prospect of the planned building

To assess the results of simple house design planning is to give a score according to the object. The alternative assessment score refers to a Likert scale, 4=very good; 3=good; 2=good enough; 1=not good. The interpretation of the assessment categories can be seen in table 9.

Table 9
Simple home design business product project planning assessment interpretation

Interval	Category
$X \geq 75$	Very Good
$50 \leq X < 75$	Good
$25 \leq X < 50$	Good Enough
$X < 25$	Not Good

The final assessment of the business product – making simple house type sketch designs

The criteria of the final product assessment – making simple house type sketch designs can be seen in table 10.

Table 10
Final product assessment criteria of simple house sketch designs

No	Criteria	Sub Criteria
1	overall building sketch	arrangement of sketch layout, plans, views, sections, and details that are balanced with sketch paper
		the suitability of the use of sketch lines, both thick/thin lines and types of lines used in floor plans, plans, looks, cuts, and details
		the suitability of the use of numbers, letters, and symbols in floor plans, plans, appearances, sections and details
		the suitability of the scale of the floor plan with the size of the paper used
		the suitability of the notations of building materials used in floor plans, plans, looks, sections and details
		completeness of size/dimension instructions, different floor heights, and on floor plans, plans, views, sections and details
		arrangement of building accessories on the floor plan in accordance with the function of the space
		completeness of the sketch, which in their entirety are floor plans, plans, views, sections, and details
		the suitability of the 3D sketch with the plan, and compatibility in terms of line thickness, color, textures, patterns, lighting, shadows, line detail accuracy and point of view
2	the use of materials in buildings according to the type	the accuracy of the use of materials in the construction section
		dimensional accuracy of materials in construction building
		variations in the use of materials in construction building
		the building materials used in the plan are easy to find
3	calculation of the estimated cost of the building according to the type	the accuracy of calculating the volume of all building components
		accuracy of unit price of work
		accuracy of price analysis per volume of building works
		the accuracy of the calculation of the total recap of building works
		conformity of the determined building price
		the attractiveness of the cover and the neatness of the product arrangement
		the attractiveness and completeness of the explanation in the brochure

To assess the final product of simple home designs is to give a score according to the object. The alternative assessment score refers to a Likert scale, 4=very good; 3=good; 2= good enough; 1 = not good. The interpretation of the assessment category can be seen in table 11.

Table 11
Interpretation to assess the results of simple home design products

Interval	Category
$X \geq 75$	Very Good
$50 \leq X < 75$	Good
$25 \leq X < 50$	Good Enough
$X < 25$	Not Good

Data analysis

To see the difference between the Experimental and Control Groups, this study used t-test. Performed prerequisite tests were normality test and homogeneity test for each data group.

Validity and Reliability of Instrument

The instrument was validated through expert judgment, while its validity was measured using Cronbach's Alpha analysis. The results of the validity test using Cronbach's alpha were significant, while the reliability test obtained a value of 0,912 sig. > 0,80.

FINDINGS

Student achievement in CPE-SA-ECC Integrated Subject taught using Entrepreneurship Learning Model based on Construction Building Project

Based on the analysis requirement test, it is known that data in each Experiment Group and Control Group is normally distributed, and the variance is homogeneous. Then to determine student achievement in the CPE-SA-ECC Integrated Subject taught using Entrepreneurship Learning Model based on Construction Building Project, a statistical t-test was carried out. Furthermore, from the results of the statistical difference test (t-test) with $\alpha = 0.05$, it is known that tcount > ttable (7.565 > 1.687). This means that student achievement in the Integrated Subject taught using Entrepreneurship Learning Model based on Construction Building Project is significantly better than student achievement in the Integrated Subject which was taught conventionally using lecture method.

Level of Application of Entrepreneurship Learning Model based on Construction Building Project

Thirty students' perception of the implementation of Entrepreneurship Learning Model based on Construction Building Project in CPE-SA-ECC Integrated Subject were assessed in Experiment Class. Based on the results of the assessment, the average is 41.86; if it is changed to a standard value of 100, the score is 79.65, and the ideal standard deviation is 6.67. Interpretation of data related to students' perception of the application of Entrepreneurship Learning Model based on Construction Building Project can be seen in table 12.

Table 12
Interpretation of students' perception data of the application of entrepreneurship learning model based on construction building project

Interval	Score Conversion to 100	Frequency	Percentage	Category
$X \geq 42.02$	$X \geq 80.00$	6	20,00 %	Very Good
$34.02 \leq X < 42.01$	$60.00 \leq X < 80.00$	11	36,67 %	Good
$25.98 \leq X < 34.02$	$40.00 \leq X < 60.00$	9	30,00 %	Fairly good
$17.99 \leq X < 25.98$	$20.00 \leq X < 40.00$	4	13,33 %	Poor
$X < 17.99$	$X < 20.00$	0	0 %	Not Executed
Total		30	100%	

Based on the average value obtained of 41.86 then compared with the categorization in table 5, the implementation of Entrepreneurship Learning Model based on Construction Building Project according to students is in the good category, meaning that the learning stages in Entrepreneurship Learning Model based on Construction Building Project can be carried out by teachers without any problems.

Besides, teachers' perception of the application of Entrepreneurship Learning Model based on Construction Building Project was assessed by 3 teachers in Experiment Class. Each teacher assesses peer teachers - 2 teachers. In total, there are six assessments. Based on factual data filled in by 3 teachers who assessed each other regarding teachers' perception of the implementation of Entrepreneurship Learning Model based on Construction Building Project, the ideal average was 27.00 and the ideal standard deviation was 6.00, the average (mean) was 39.12, when converted to the standard value of 100, the score is 83.67. The interpretation of the data related to teachers' perception of the implementation of the learning model based on Construction Building Project can be seen in table 13.

Table 13
Interpretation of teachers' perception data of the application of entrepreneurial learning model based on construction building project

Interval	Score Conversion to 100	Frequency	Percentage	Category
X ≥ 37,80	X ≥ 80.00	4	66,67%	Very Good
30,60 ≤ X < 37,80	60.00 ≤ X < 80.00	1	16,67%	Good
23.40 ≤ X < 30.60	40.00 ≤ X < 60.00	1	16,67%	Fairly good
16.20 ≤ X < 23,40	20.00 ≤ X < 40.00	0	0%	Poor
X < 17.99	X < 20.00	0	0%	Not Executed
Total		6	100%	

Based on the average value obtained of 39,12 then compared with the categorization in table 7, it can be understood that the implementation of Entrepreneurship Learning Model based on Construction Building Project according to teachers is in the very good category, meaning that the learning stages in Entrepreneurship Learning Model based on Construction Building Project can be applied by teachers without any problems.

The level of product design planning – simple house sketch design quality made by students in Entrepreneurship Learning Model based on Construction Building Project

The assessment of simple house design planning was carried out by 3 vocational high school industry who are successful in entrepreneurship in property sector and by teachers of CPE, SA, and ECC subjects. The assessment was carried out when students presented their projects in front of other students, industry, and teachers. The results were then compared using criteria in table 9. The interpretation of industry and teacher assessments of simple house type design planning can be seen in table 14 and table 15.

Table 14
Interpretation of industry assessment results of simple house type design planning

Group	House Type	Average Score	Category
I	36	58.95	Good
II	45	52.94	Good
III	56	51.27	Good
IV	60	76.82	Very Good
Average		59.99	

Based on the average value obtained in table 14 of 59,99 then compared with the categorization in table 9, the business product of simple home design planning according to industry is in the good category.

Table 15
Interpretation of teacher assessment results of simple house type design planning

Group	House Type	Average Score	Category
I	36	61.79	Good
II	45	75.15	Very Good
III	56	68.97	Good
IV	60	80.16	Very Good
Average		71.52	

Based on the average value obtained in table 15 of 71,52 then compared with the categorization in table 9, the business product of simple home design planning according to teachers is in the good category.

The level of quality of the final product – simple house sketch designs made by students in Entrepreneurial Learning Model based on Construction Building Project

The assessment of the final product – simple house designs was carried out by 3 vocational high school industry who are successful in entrepreneurship in the property sector and teachers of CPE, SA and ECC subjects. The assessment was carried out when students presented their projects in front of other students, industry, and teachers. The results were then compared using criteria in table 11. The results of the interpretation of industry and teacher assessments of the final product – simple house designs can be seen in table 16 and 17.

Table 16
Interpretation of industry assessment results of the final product – simple house designs

Group	House Type	Average Score	Category
I	36	79.66	Very Good
II	45	90.18	Very Good
III	56	87.34	Very Good
IV	60	85.67	Very Good
Average		85.71	

Based on the average value obtained in table 16 of 85,71 then compared with the categorization in table 11, the final business product – simple home designs according to industry is in the very good category.

Table 17
Interpretation of teacher's assessment results of the final product – simple home designs

Group	House Type	Average Score	Category
I	36	77.94	Very Good
II	45	94.07	Very Good
III	56	89.06	Very Good
IV	60	87.96	Very Good
Average		87.26	

Based on the average value obtained in table 17 of 87,26 then compared with the categorization in table 11, the final business product of simple home designs according to teachers is in the very good category.

These findings when reviewed using Barrow's syntax can be explained that, from the 10 Sub-Indicators contained in The Entrepreneurship Learning Model Based on Building Construction Projects from the observations there is a significant change in students. This change appears when this model can be implemented properly. The following explains the description of student changes according to the elements and sub-indicators.

Table 18
Student changes in the entrepreneurship learning model based on building construction projects when viewed using barrow's syntax

Element	Sub Indikator	Before	After
Problem	1, 2,	Students have difficulty determining the theme of the product to be produced	Students are more active and can simulate product design themes according to their talents and interests
Idea	3, 4, 5	Students have difficulty in preparing business plans and identifying production materials	Students find it easier to develop business plans and market analysis
Knowledge	6	Students lack confidence in producing product design	Students are more confident and eager to innovate production designs
Learning Issue	7	Students have difficulty in preparing production marketing plans	Students have more ideas and innovations in preparing production marketing plans
Action	8, 9, 10	Student product results are less in line with market needs	Students produce products that are in accordance with the market and product development innovations can be carried out

DISCUSSION

Student achievement in CPE-SA-ECC Integrated Subject taught using Entrepreneurship Learning Model based on Construction Building Project

The results show that the application of Entrepreneurship Learning Model based on Construction Building Project could improve student achievement in the integrated subjects of Creative Products and Entrepreneurship (CPE), Software Applications (SA), and Construction Cost Estimation (ECC), compared to student achievement in Control Group taught using lecture method. This happens because Entrepreneurship Learning Model based on Construction Building Project can encourage students to be active in learning activities. This will be different if students are taught using lecture method – students tend to be passive and bored. So that the expected learning objectives cannot be optimally achieved.

Entrepreneurship Learning Model based on Construction Building Project teaches students not only to be able to receive lessons but also to learn critical thinking, hone skills and have an entrepreneurial spirit. This is in line with the literature which states that the application of the entrepreneurial learning model can train students to develop an entrepreneurial spirit more systematically and gain valuable experience that will help them to develop entrepreneurial intentions in everyday life (Darmawan et al., 2021). In

addition, the application of the entrepreneurial learning model is considered to provide opportunities for students to take the initiative, reflect, find solutions with their ideas, and produce something useful for others (Pratomo, et al. 2021). On the other hand, it can facilitate students to develop critical thinking skills, problem solving skills, communication skills, collaborative skills, observational skills, and creativity and innovation (Atmojo et al., 2022). Teachers are not merely delivering subject theory, but also must be able to foster working spirit on their students. This is in line with the literatures which state that teacher's role is to guide students in learning, develop psychomotor skills (sketching process) and social skills such as seeking information from various sources, critical thinking, problem solving, self-evaluation, summarizing and giving presentations which are highly recommended for lifelong learning, (Syukriah, Nurmaliah, & Abdullah, 2019; Syakur et al., 2020; Santyasa, Rapi, & Windu, 2020; Han et al., 2015; Aldabbus, 2018; Kokotsaki, Menzies, & Wiggins, 2016).

Learning using integrated model like this must be applied, not only to entrepreneurship subjects but also to other subjects. Integrated learning model requires students to be able to organize, manage, and apply their knowledge not only in one subject, but in other related subjects; so that it will be effective to give understanding and practical skills to students. It is proven by this study that the students can plan and carry out entrepreneurial activities, and can estimate the profits and losses of their business.

In essence, this research has theoretical and practical implications. In theory, the application of the learning model in this study can equip students with competencies according to the Creative Products and Entrepreneurship (PKK) subject which are synchronized with conditions in the world of work and industry. This research can be used as a reference for further researchers in developing learning models. The development of learning models is always carried out in a sustainable manner according to the demands of the world of work, 21st century skills and the implications of industry 4.0. Practically the application of this learning model is expected to provide an overview of students related to the field of entrepreneurship. This means that students are expected to be able to start a business or entrepreneurship according to their area of expertise after graduating with the provision of competencies that have been trained at the vocational school level.

Implementation Level of Entrepreneurship Learning Model based on Construction Building Project according to student and teacher assessments

Based on table 12, the level of students' perception of the application of Entrepreneurship Learning Model in CPE-SA-ECC Integrated Subject is done well. This means that according to students, teachers can carry out their roles to the fullest - starting from explaining the objectives and scope of learning materials; explaining the concepts, values, and stages of Entrepreneurship Learning Model based on Construction Building Project; explaining the meaning, purpose and stages of filing IPR; explaining of the project topic selection criteria; explaining the uses and components contained in the business plan; explaining the assessment criteria and how to present a business plan; explaining things needed to be prepared in project implementation; explaining how to work on a project (to produce products/services

designed by students); explaining the packaging of the project's final product for presentation; to explaining the evaluation criteria for the final product of the project.

One suggestion for similar research is that it is better to add media use indicator in the material explanation. This means that teacher competence in using learning media is added as an indicator of student assessment, especially in current Covid-19 pandemic, where learning activities cannot be done face-to-face but are carried out using an online system. Online learning is an open and distributed learning system using pedagogical tools or educational aids made possible through the internet and network-based technology to facilitate learning processes and knowledge formation through meaningful actions and interactions (Dabbagh, N. and Ritland. BB 2005). Teachers must ensure that teaching and learning activities continue, even when students are at home. This requires teachers to be able use online platform as learning media. The learning media should not only able to convey lesson materials, but also capable of carrying out online face-to-face communication online, online assignments, online exams and capable of receiving feedback from students. Some online platforms that can be used for learning media include using Google Classroom, Webex, Zoom, and Google Suite.

Meanwhile, the level of teachers' perception of the application of Entrepreneurship Learning Model in CPE-SA-ECC Integrated Subject has been very well done. This can be proven by table 13 showing that 66.67% of responses are included in the very good category. This means that the overall learning stages in Entrepreneurship Learning Model based on Construction Building Project can be carried out by teachers without any problems. The success of teachers in implementing Entrepreneurship Learning Model based on Construction Building Project can be seen from several indicators: students identifying topics needed by construction building business actors; students determine the topic of the project; students develop business plans (market analysis, production, capitalization, and marketing); students present their business plans in front of teachers and business actors; in group, students prepare the necessary project requirements; in group, students working on projects to produce products/services; in groups, students pack the final product of the project to be presented; in group, students presenting project products in front of teachers & business actors; in group, students improve project products if they do not meet the assessment criteria.

The level of product design planning – simple house sketch design quality made by students in Entrepreneurship Learning Model based on Construction Building Project

The simple house design planning was assessed by external and internal parties. The assessment should be Valid, Educating, Competency Oriented, Objective, Fair, Integrated, Open, Economical, and Accountable (Suwandi, 2010). Industry in construction service industry were involved as external parties to assess the planning of simple house designs. The involvement of industry in the assessment was because they can provide an assessment that is tailored to the standard criteria for needs in the real industrial world. This is in line with literatures stating that the quality of product

planning is the most desired reference by the industry (Patacsil, Lourrine, & Tablatin, 2017; Torun, 2018; Sopa et all., 2020). Based on table 14, the level of industry assessment of the simple house sketch designs is in the good category. This means that the planning of a simple house sketch designs is in accordance with the needs of the industry. The involvement of in the assessment can help identify opportunities and threats in relation to learning activities, as well as anticipating changes in the industry.

If the assessment of the results of simple house designs is above average, it means that learning activities in schools have referred to the standard criteria for the needs of the industry, especially in the field of construction services. The synchronization between learning activities and competencies in the industry can provide opportunities for students to be better prepared to enter job market, and not to be overwhelmed by job market demands. Students also will be easy to adapt and develop their abilities.

However, if the assessments from external and internal parties are far below the average, it can also be a threat to learning activities in schools. This is possible because there is no correlation of learning activities in schools to the knowledge and skills demanded in job market. There should be changes in the learning system, both through school tasks, changing delivering material methods and assessment criteria, as well as the school curriculum. In addition, there is also a need for periodic updates on the subject materials to adapt to the latest changes in the industry. This must be done to anticipate changing demands in job market, especially in this rapid-evolving technology era.

In addition to assessments carried out by external parties, entrepreneurship subject teachers as internal parties also assessed simple house design planning. Based on table 15, teacher's assessment is in the good category. This means that students carry out simple house design plans according to specified criteria.

In general, the assessments both from external and internal parties include several indicators: floor plan, parts, front view and side view, roof plan, materials used, and estimated costs. In similar research, it is better to include 3D design assessment criteria. In addition to training students' skills in designing 3D sketches, 3D design assessment criteria will ease users to understand the planned designs.

The level of quality of the final product - simple house sketch designs made by students in Entrepreneurial Learning Model based on Construction Building Project

Like the assessment of the simple house design planning, the assessment of the final product – simple house designs also involved industry as external parties and teachers as internal parties. Based on table 16, the industry assessment of the final product of simple house designs is in the very good category, the same as the interpretation category of teacher's assessment (see table 17). In general, it can be concluded that the final products – student-made simple house sketches have met the assessment indicators: overall building design, the use of materials in buildings according to their type and the calculation of the estimated cost of the buildings according to their type. The assessment of the final product of a simple house sketches is in line with similar research which states that research with an integrated system can support theoretical studies on aspects

of quality improvement which include emancipation, student self-reflection, being critical, connecting cross-disciplinary complex problems to find solutions, building cross-disciplinary communication, interdisciplinary collaboration processes and teamwork, and using integrative potential to create innovations emerged from mentoring processes (Shen, Sung & Zhang, 2015; Neck & Corbett, 2018; Wenninger, 2019; Kundu, A., & Bej, T., 2020).

In similar research, it is better to include making up miniatures as part of the assessment criteria. Miniatures or imitations are smaller shapes that resemble houses, buildings, planes, ships, and other objects, which are usually made of wood, straw cardboard and styrofoam (Hermita, 2015). Miniatures are usually used to easily describe or represent the actual state or the state that will be created (Aldjufri, 2016). Miniatures are very important as a supporting tool so that users can more easily understand the final designs. Besides, the making of miniature will also encourage students' creativity; whether it's in the form of how to make miniatures, the materials used and time management in the making process.

Research conducted by Belland, et. al. (2020) explains that through PjBL students can develop skills independently and can solve problems according to their respective learning. This is in line with the research conducted by us. Choi (2019) explained that through PjBL integrated with loop media it can foster critical thinking and problem solving in medical education according to Barrows' taxonomy (1986). This PjBL implementation uses 3D media in learning activities.

Doherty, at. al. (2018) explained that through integrated PjBL in medical schools, the results were very good, namely that it could foster collaboration skills between students, could increase cooperation by 68% and increase the response rate in learning by 89%. This learning still needs to be developed for tutorials on the use of technology in medical schools.

CONCLUSION

Based on the research that has been done, the following conclusions can be drawn: (1) Vocational high school student achievement in Creative Products and Entrepreneurship (CPE), Software Application (SA), and Construction Cost Estimation (ECC) Integrated Subject taught using Entrepreneurship Learning Model based on Construction Building Project is significantly better than if taught using lecture method; (2) Students' assessment of the implementation of Entrepreneurship Learning Model based on Construction Building Project is good. Meanwhile, teacher's assessment of the implementation of Entrepreneurship Learning Model based on Construction Building Project is very good; (3) Industry assessment of the quality of simple house design planning by students in Entrepreneurship Learning Model based on Construction Building Project learning is good. Meanwhile, teacher's assessment of the quality of the student's simple house sketch design planning in the Learning Model of Entrepreneurship Learning based on Construction Building Project is good; (4) Industry assessment of the quality of the final product – simple house sketch designs made by students in Entrepreneurship Learning Model based on Construction Building Project

learning is very good. Meanwhile, teacher's assessment of the quality of the final product – simple house sketch designs by students in Entrepreneurship Learning Model based on Construction Building Project learning is very good.

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