How Project-Based Learning and Direct Teaching Models Affect Teamwork and Welding Skills Among Students

Nizwardi Jalinus[a], Syahril[b*], Rahmat Azis Nabawi[c], Yaumal Arbi[d],
[a,b,c,d]Fakultas Teknik, Universitas Negeri Padang, Padang, Indonesia, Email: [b*]syahril@ft.unp.ac.id

In the twenty-first century, many employers prefer candidates whose soft skills exceed their hard skills. In this article, the researcher compares project-based learning models and direct teaching, for welding skills and teamwork skills among vocational high education students. Welding skills are seen as hard skills and teamwork skills are viewed as soft skills. The research method used was experimental research. The results show that with the implementation of a project-based learning model, learning activities students have higher teamwork than welding skills, while with the implementation of a direct teaching model, learning activities students have higher welding skills than teamwork skills. This study shows that the implementation of different learning models, and the different competence ratio of hard skills and soft skills owned by students in a model of project-based learning, is very appropriate for twenty-first century learning that prioritises learning outcomes owned by students higher on soft skills.

Key words: *Project Based Learning, Direct Teaching, Welding Practice Course, Teamwork and Welding Skill.*

Introduction

One of the main goals of learning in vocational education is that students acquire competencies that match those required by the labour market. Therefore, the teacher must choose a learning model which can achieve that goal. One measure of the selection of learning models is their effectiveness in providing opportunities for students to develop competencies that match labour market needs. Many studies reveal the competencies that

prospective employees must have, to be absorbed by labour markets. In the twenty-first century, employers not only require workers who have technical skills (hard skills), but the workforce must also have non-technical skills (soft skills). Ramlan and Ngah (2015) state that the era of globalisation raises challenges and demands on the world of education, to change the purpose of learning, to not only improve students' 'hard skills' but also their 'soft' skills.

Hard skills are a person's ability to do a job, such as engineering, accounting, teaching, firefighting, cooking, sewing, etc. (Arat, 2014). Hard skills are defined techniques or measurable work management practices (Junrat et al., 2014). Soft skills are a non-technical skill that places greater emphasis on other matters; namely interpersonal, intrapersonal and behavioural skills required in any work environment, such as personality traits, social gracefulness, fluency in the language, personal habits, friendliness, optimism, personality, attitude, morality, lifelong learning and information management, communication and presentation, adaptability, teamwork, listening skills, development and construction of innovation, analytical thinking and problem solving, professional skills and creative thinking skills (Arat, 2004; Pachauri and Yadav, 2004; Wallapha, 2012; Matteson, 2016). Non-technical skills are social (communication, teamwork), cognitive (decision making, situational awareness), and personal resource skills (overcoming fatigue and stress) that complement technical performance and contribute to safety and efficiency (Hull et al., 2016; Jabarullah et al., 2020).

According to AC Nielsen Research Services (2000), employers need workers who have skills such as creativity, innate ability, communication, problem solving and teamwork. Seat et al. (2001) demonstrated that interpersonal skill, communication and teamwork skills of graduated engineers, otherwise known as performance skills, are a concern for employers. Wulandari et al. (2015) revealed that in the work environment, in addition to skills and knowledge, good teamwork is also required to solve a problem. Based on the study by Setiawan and Soenarto (2017), it can be concluded that from the categorisation of the effective competency of vocational education graduates required by the industry, there are three competencies that have a high level of needs; teamwork skills, self-management skills, and technology skills. Vocational education, as an institution that prepares ready-to-work human resources, should respond to this, by creating lessons that develop more soft skill than hard skill students. The challenge of producing graduates with competent skills and knowledge to fill the labour market, has been put to the education system (Rongraung, 2014). The orientation of vocational education is towards practical learning; the taught material is adapted to the needed competence in the workplace and it is emphasised that the student must improve work skills (Mustapa, Ibrahim and Yusoff, 2015).

Teachers must design effective learning, by choosing the right learning model that develops soft skills. This is in line with the opinion of Ariratana et al. (2015) that teachers should

design learning activities that make students enjoy learning, have good learning habits and acquire learning through experience of social interaction. The teacher is commonly seen as a designer of learning (Bennett, Agostinho, and Lockyer, 2016). In designing of learning, educators try, adapt, create and develop from various sources to solve the challenges of learning design (Garreta-Damingo and Hernández-Leo, 2018). Teachers should have special abilities on how to deliver course material that can adapt to students' needs (Ahmad, et al. 2014).

In response to demand, industrial needs and changes in the field aspect of effective learning, vocational learning needs to be applied towards student-centred learning. Hua et al. (2011) reveal that one of the important issues of student-centred learning approach that is changing the role of teachers and students, in teaching and learning activities. Methods of thinking, which are about learning and teaching, emphasise the responsibility of students in learning activities such as planning, interacting with teachers and other students, doing research, and evaluating learning, are a hallmark of the student-centred learning environment (Bakar et al., 2013). In such learning activities, students will actively learn to develop their competence. Students should change their passive learning habits actively to participate in learning activities (Shih and Tsai, 2017).

Project-based learning (PjBL) is one of the model that put students at the centre of learning (Koparan and Guven (2014). Its implementation in vocational education is appropriate. According to Xinyan (2016), PjBL is very suitable for vocational education because almost all products and services can be a project task for the student. Learning a mechanical machining course at vocational high school with the application of PjBL has the potential to improve students' hard skills and soft skills (Sudjimat, 2016).

However, teacher-centred learning, such as direct teaching (DT), is still widely implemented in vocational education. DT is very popular in learning practice because it supports students' learning processes related to declarative and procedural knowledge (Arends and Kilcher, 2001; Blik et al., 2014). DT is a teacher-centred learning model, which means the teacher is responsible for setting up the learning objectives in full, and has an active role in explaining the content or skills to the students (Kardi, 2001). In learning with DT, teachers predominantly organise plans, learning materials, and plan when and how the feedback will be given to students (Celik and Vuran, 2014). The reasons DT has been widely applied by teachers are as follows: (1) students learn by imitating what the teacher does, (2) practical learning in vocational education is generally related to the use of machinery, so that there is concern about work accidents when students practice, 3) students' skills are not in accordance with requirements, and (4) the teacher can fully control learning.

In this article, the researcher discusses welding skills, and teamwork skills in learning shielded metal arc welding (SMAW) technique, through the implementation of DT and PjBL in vocational high school. Welding skills and teamwork skills are interpreted as the students' hard and soft skills respectively.

Literature Review

Vocational Education System in Indonesia

UNESCO formulated an educational qualification known as the International Classification of Education (ISCED). To equalise Indonesia's education qualifications with international qualifications formulated by UNESCO, the Indonesian government formulates the Indonesian National Qualification Framework (known in Indonesian as KKNI: '*Kerangka Kualifikasi Nasional Indonesia*'). This government policy was contained in the Presidential Decree No 8/2012 (The Republic of Indonesia, 2012). According to the Indonesian National Qualification Framework (INQF), vocational education starts at level 2 to level 9. Level 1 is a graduate of primary education (6-year primary school + 3-year junior high school). The tracks of vocational education in Indonesia are explained in Figure 1:

1. The graduates from vocational high school (3 years) equivalent to level 2,
2. The graduates of Diploma 1 (D1) or 1-year Diploma equivalent to level 3,
3. The graduate Diploma 2 (D2) or 2-year Diploma equivalent to level 4,
4. The graduates of Diploma 3 (D3) or 3-year Diploma program equivalent to level 5,
5. The graduates of Diploma 4 (D4) or 4-year Diploma equivalent to level 6,
6. The graduates of Professional Education 1 (PE1) are equivalent to level 7,
7. The graduates from Applied Master (S2), Professional Education 2 (PE2) and Specialist Education 1 (SE1) are equivalent to Level 8,
8. The graduates from Applied Doctoral (S3) and Specialist Education (SE2) are equivalent to Level 9.

D1 and D2 programs are organised by universities in the form of community colleges. Diploma 3, Diploma 4, Professional Education 1, Specialist Education 2, applied magister and applied doctoral programs are conducted by universities in the form of Polytechnic, Higher School, institute or university. Levels 1 to 3 are grouped into operator positions, levels 4 to 6 are grouped in technician positions, and levels 7 to 9 are grouped in expert positions.

Figure 1. Vocational education in Indonesian National Qualification Framework
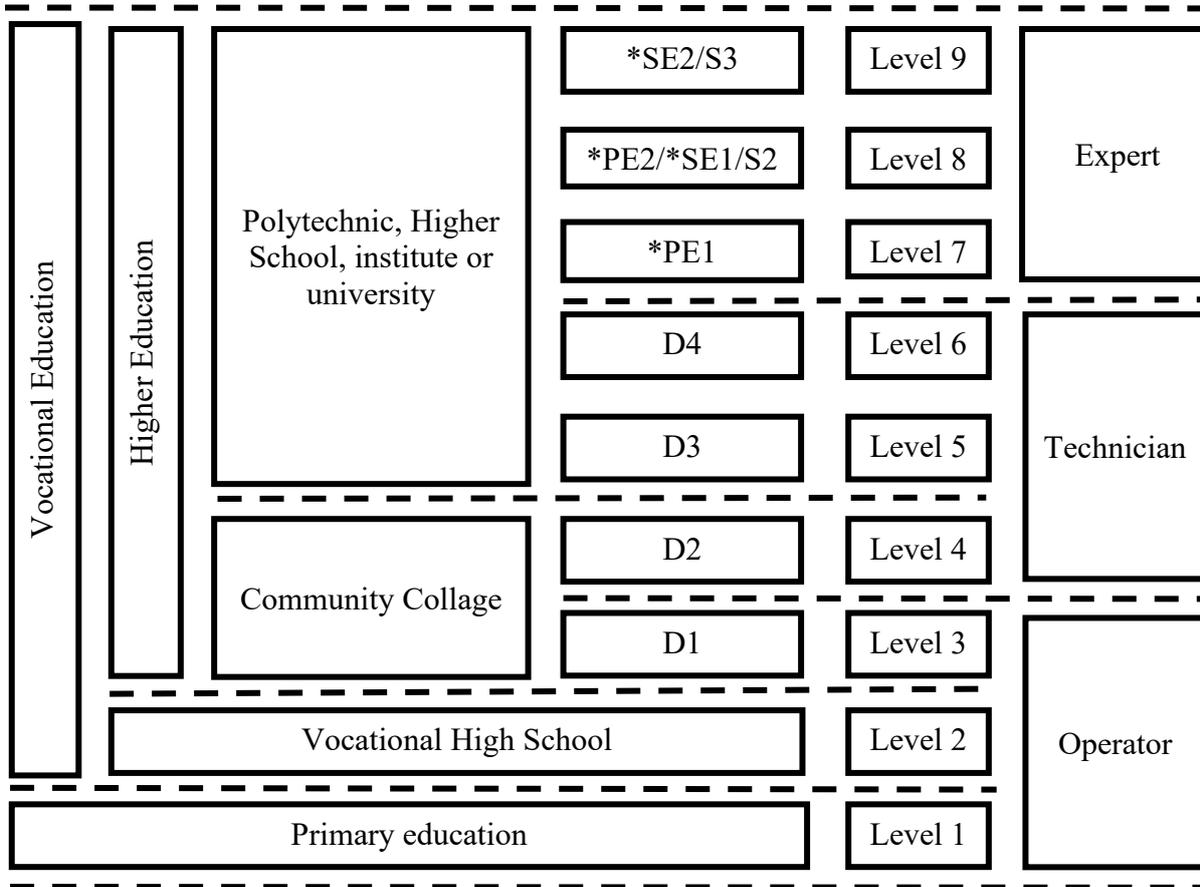

The existence of INQF can be a reference for vocational education in Indonesia to establish learning outcomes in every level of education, and for employers can be an indicator of graduate level training. According to Figure 1, the Vocational High School (SMK) produces graduates at level 2 who are included in the group of operators. Developing countries generally place great emphasis on the promotion of vocational schools at the secondary school level or vocational high school (Johnston et al., 2015). This includes Indonesia, which as a developing country continues to improve the SMK program by updating the curriculum included in the learning model implemented by teachers, to be able to produce graduates according to the demands of the times. Vocational High School aims to improve the ability of students to develop themselves in line with the development of science, technology and the arts, as well as preparing students to enter employment and develop a professional attitude (MoEC, 1992). Vocational High School is an institution which carries out education and training various skill programs suitable for employment (Munawaroh, 2017). The graduates of vocational education are expected to fill the position of operators in the world of work, in accordance with the skills studied and developed in schools.

Welding Skills on the Shielded Metal Arc Welding (SMAW)

Competence is a statement that describes a certain ability which can be observed and measured (Hal and Jones, 1976). Competence is a combination of knowledge, skills, values, and attitudes reflected in the habit of thinking and acting (Sanjaya, 2006). It can be concluded that competence is the knowledge and ability possessed by someone who can be assessed, observed and measured, and the competence is aimed at solving daily problems successfully. Competencies in the SMAW welding skills subjects, conducted in the XI Semester 1 class on vocational high school, are level with the competence of a first level welder, according to the Indonesian National Competency Standards ('Indonesian National Work Competency Standards/SKKNI'). The Indonesian Minister of Manpower and Transmigration has regulated the Indonesian National Competency Standards of the industrial sector at industrial processing sub-sector of industrial goods of metal (No KEP. 342/MEN/X/2007). The Regulation provides that the services industry of welding, the subfield of welding SMAW, and the welder level 1 on the SMAW have welding skills on a flat position (1) and horizontal position (2), and that each welding position is performed on two types of welded joint, namely fillet (F) and groove (G) (MoMT, 2007).

Figure 2. Position weld and joint type for the Welder Level 1
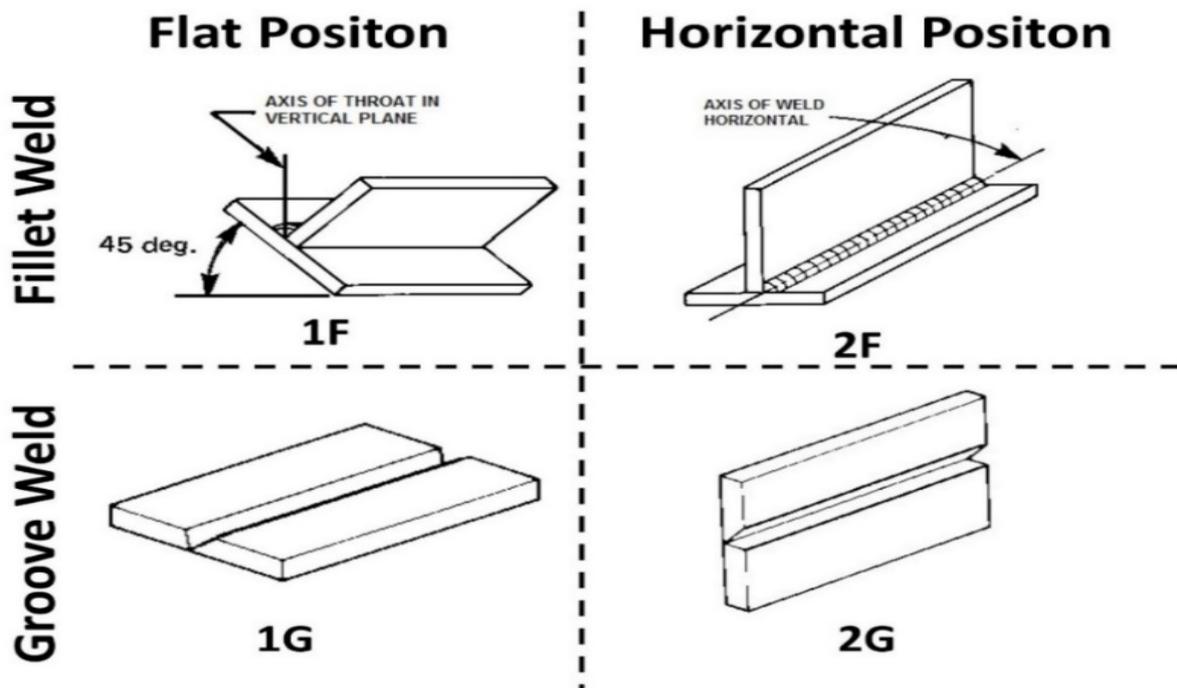
Teamwork Skills

Each prospective workforce member is not only required to have the competence of special skills individually, but is also expected to have good soft skills, to support its success in the world of work. Vocational high school, as an educational institution that prepares its graduates to enter the world of work, should be able to help develop soft skills needed by the world of work. With the development of soft skills, it is expected that vocational graduates can be more accepted in the world of work. One soft skill needed in the world of work is teamwork skills. Teamwork is a social system between two or more people who join in a group or organisation (context), where each member is connected and collaborates to achieve a goal or purpose (Lick, 2000; Hoegl, 2005; Nelson, 2007; Karakus and Toremen, 2008).

The ability to work in groups (teamwork skills) is very important, because in doing a job it is necessary to have good teamwork. Teamwork is recognised as an important competency in work culture, with most companies in the world that recruit new staff choosing job applicants who have good teamwork skills (Lau, 2014). Employees who have good teamwork skills will be able to work together in a team (Bovbjerg, 2006). Employers believe that if the school develops the students' teamwork skills in learning activities, the students will be better prepared for the workplace (Tapscott and Williams, 2010). Teamwork is an important capability in industry because in every workplace, the workforce will negotiate the methods or ways that will best achieve good results (Tucker and Abbasi, 2016). There is an interaction of mutual learning between team members, in teamwork (Williams and Duray, 2006). It can be said that teamwork is a group of individuals working together in a workplace, project or organisation to achieve common goals by sharing knowledge, capabilities and responsibilities.

Method

This study is an experimental research of non-equivalent control group design, post-test only. The researcher compared two groups, one group of students as an experimental class with learning activities based on PjBL, and one group of students again as a control class with learning activities based on DT. The population in this research is 30 students consisting of two localities, that is 15 people as the experiment class and 15 people as the control class, at a vocational high school. To avoid bias, students in both classes of this study designed a study group. In the control class with the implementation of the DT model, the students learned SMAW welding skills in groups at level 1, and each group consisted of three students. In the experimental class with the implementation of PjBL, the students also designed learning in groups with the same number of team members, which is three people, and learned the SMAW welding skills level 1 as augmented by making project tasks lifted from real-world problems.

Research Design

Experiment class

In the experimental class, the learning activity of welding technique of SMAW was carried out by implementing PjBL using 7 PjBL model syntax. That syntax consists of: (1) formulating expected to learn outcomes, (2) understanding the concept of teaching materials, (3) training skills, (4) designing the project-based theme, (5) marking the project proposal, (6) executing the tasks of projects, and (7) presenting the project report (Jalinus and Nabawi, 2017). The explained learning activities experimental class which implemented PjBl, with 7 syntaxes, is shown in Figure 3.

Figure 3. Learning activity of the welding technique SMAW on the experimental class based on implementation PjBL

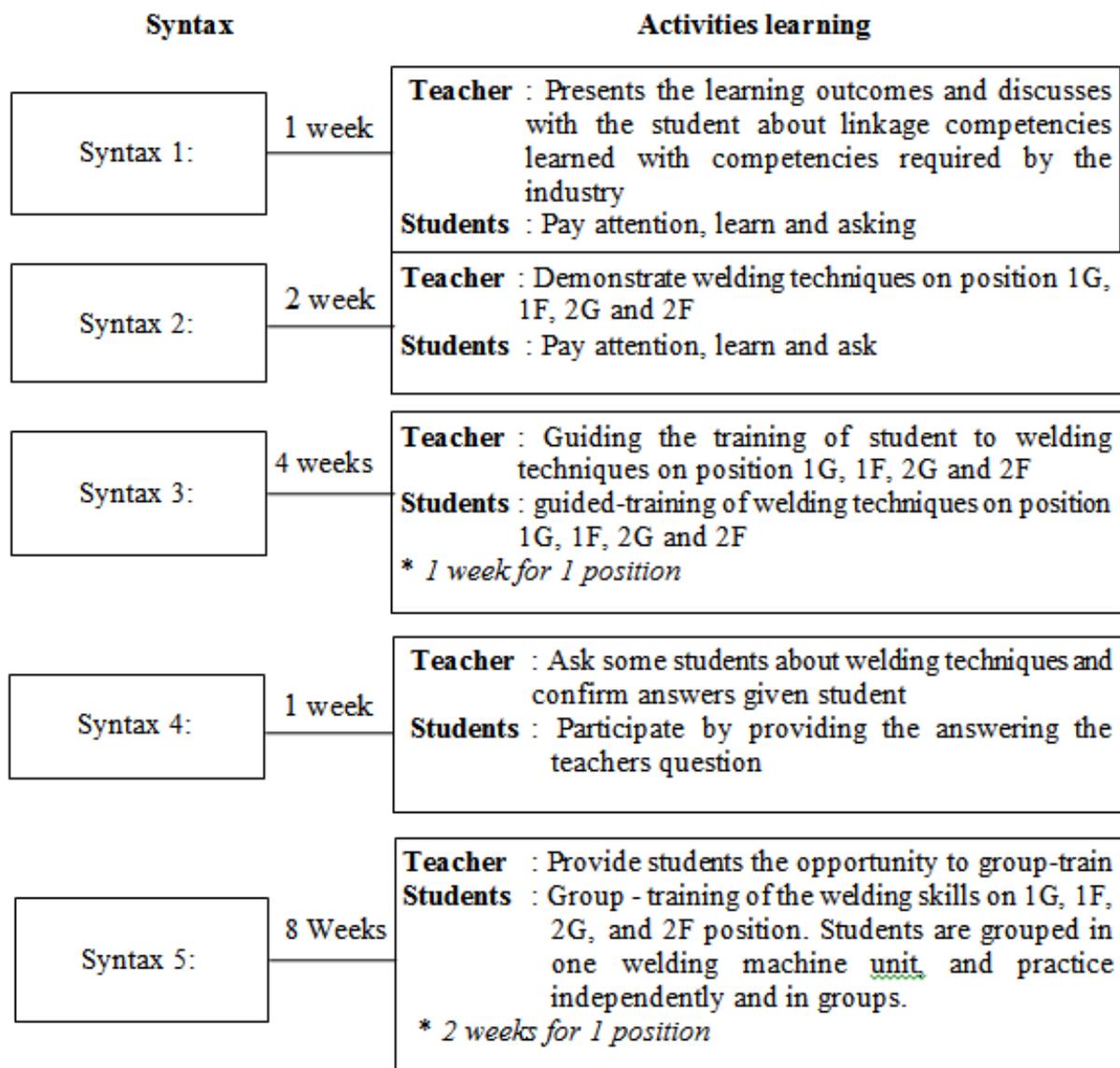| Syntax		Activities learning
Formulation expected learning outcome	1 week	Teacher presents the learning outcomes and discusses with the student about linkage competencies learned with competencies required by the industry
Understanding the concept of teaching materials	2 weeks	Self-learning using learning module, groups discussions, class presentation of specific topics teaching materials by the student groups learning, and the confirmation of the teacher about the achievement of students' knowledge competence
Training Skills	4 weeks	Welding skills training at position 1G, 1F, 2G and 2F use SMAW. The training activity at each weld-position consists of: the teacher demonstrating weld technique, students perform welding skills training and teachers do guidance, assess student welding results, and evaluate students weld skills.
Designing the project-based theme	1 week	Discussion of teachers with students on the theme of project tasks by considering their attachment to learning outcomes, real-world urgent issues, availability of materials and tools in the workshop, and the time required to complete project tasks are possible.
Marking the Project proposal	2 weeks	Students make project proposals according to templates, discussion in the groups, and guidance with the teacher. The teacher does a review, assessing and deciding to approve and continue to the stage of executing the tasks of projects or revising the project proposal.
Executing the tasks of Projects	7 weeks	Students work on project tasks in groups, divide individual work assignments, discussions to solve problems found, discussions and tutorials with teachers and check the quality of the projects created. Teachers supervise, counsel, facilitate, motivate, assess and evaluate the implementation of project tasks undertaken
Presentation the The project report	1 week	Students present project reports in small seminars in class, class discussions where other students provide questions or inputs and groups who present give answers and confirm. Teachers provide questions, assess and evaluate student project work.

Control Class

In the control class, learning activities as to welding techniques SMAW is implemented based on the DT model. According to Amri and Khoiru (2010), DT has five syntaxes implemented during the lesson: (1) explanation of the learning outcomes and student preparation (2) demonstrate knowledge or skill, (3) provide guided practice, (4) check for understanding and provide feedback, and (5) provide practice in the group learning.

Figure 4. Learning activity of the welding technique SMAW on the control class based on the implementation DI model

Syntax		Activities learning
Syntax 1:	1 week	**Teacher** : Presents the learning outcomes and discusses with the student about linkage competencies learned with competencies required by the industry **Students** : Pay attention, learn and asking
Syntax 2:	2 week	**Teacher** : Demonstrate welding techniques on position 1G, 1F, 2G and 2F **Students** : Pay attention, learn and ask
Syntax 3:	4 weeks	**Teacher** : Guiding the training of student to welding techniques on position 1G, 1F, 2G and 2F **Students** : guided-training of welding techniques on position 1G, 1F, 2G and 2F * *1 week for 1 position*
Syntax 4:	1 week	**Teacher** : Ask some students about welding techniques and confirm answers given student **Students** : Participate by providing the answering the teachers question
Syntax 5:	8 Weeks	**Teacher** : Provide students the opportunity to group-train **Students** : Group - training of the welding skills on 1G, 1F, 2G, and 2F position. Students are grouped in one welding machine unit, and practice independently and in groups. * *2 weeks for 1 position*

Instrument

Instrument Teamwork Skills Student

Teamwork skills are an ability of the individual, each whom is a team member with the same interests and goals. Assessment of teamwork skills using authentic assessment techniques was performed by observers using the rubric of teamwork assessment. Teamwork skills students' items on the rubric assessments refer to six factors that affect the success of teamwork expressed by Tarricone and Luca, (2002), presented in Table 1. These factors must be owned by each team member so that the built team can be successful according to the purpose of the team's formation. Description of each factor is modified to be an indicator of the assessment of the student's teamwork skills. The observer assesses the teamwork skills of each student in control and experiment classes with a score range of 1 to 5.

Table 1: Indicator for the assessment teamwork skills students (modified from Tarricone and Luca, 2002)

Factors	Indicator for the assessment teamwork skills students	Score 1 - 5
Commitment to team success and shared goals	Have a commitment to success and team goals	
Interdependence	Have a high contribution to succeed success and team goals	
Interpersonal skills	Have the ability to discuss issues openly with team members, honest, trustworthy, supportive, show respect and commitment to the team	
Open communication and positive feedback	Have good communication and feedback skills, actively listen to the problems and needs of team members, appreciate contributions from other team members and create an effective working environment	
Appropriate team composition	Recognizing the role of members of the team by fully completing the assigned work portion of the team	
Commitment to team processes	Has responsibility for contributing to the team	

Instrument Welding skills students level 1

To assess the welding skills of level 1 students, researchers refer to the Indonesian National Competency Standards for SMAW welding level 1. Assessment is done by observers with a rating scale of 1 to 5.

Table 2: Competence levels (Kompetensi pengelasan) SMAW level 1 (MoMT, 2007)

Category	Competency	Description	Score 1 - 5
General competency	Good two-way-communication	This competence relates to the knowledge, skills and attitudes needed to implement mutual communication.	
	Identify the principles of occupational safety and health	This competence is related to the knowledge, skills required in performing the SMAW welding work and work attitude related to welding work applications that are in accordance with the standard operating procedure (SOP).	
Core-competency	Competencies of the measure with basic mechanical measuring instruments	This competence is related to the knowledge, skills and work attitude required in carrying out the work of measuring the mechanical components of the welding industry services	
	Reading simple sketches or drawings of mechanical	This competence relates to the knowledge, skills and work attitude required in reading and applying simple sketch drawings and/or drawings of mechanical components to the welding industry services.	
	Using hand tools and power tools	This competence relates to the knowledge, skills and working attitude required in the use of various hand tools and light machines (hand and power tools) on welding services industry	
	Doing mechanical cutting	This competence relates to the knowledge, skills and work attitude required in carrying out mechanical cutting work on the welding services industry.	
	Doing out cuts with oxy-gas cutting	This competence relates to the knowledge, skills and working attitude required in carrying out the oxy-gas cutting on the welding services industry.	
	Doing basic welding with SMAW	This competence relates to the knowledge, skills and working attitude required to apply the basics on the carbon steel plate and/or pipe on the position under hand (flat) and horizontal by SMAW on welding services industry.	

	Weld at the plate steel on the flat position by SMAW	This competence relates to the knowledge, skill and works attitude required in welding of plates under the hands (flat) with SMAW in welding services industry	
	Welding plate steel on the horizontal position with SMAW	This competence is related to the knowledge, skill and work attitude required in welding horizontal plate with SMAW on welding services industry.	
Specific-competency	Make a report	This competence relates to the knowledge, skills and working attitude required in making reports relating to the welding services industry.	
	Doing basic engineering calculations	This competence relates to the basic knowledge required to perform the necessary mechanical or engineering calculations on the services of the welding industry	

Data Analysis

Data analysis is data processing obtained by using the formulas or rules that exist in accordance with the research approach taken. The results of teamwork skills and welding skills students' assessment were analysed using descriptive statistics, a normality test, a homogeneity test and a t-test. The normality test was conducted using Kolmogorov-Smirnov statistics (sig.> 0.05), and a homogeneity test using Levene Statistics test (sig.> 0.05), to determine if there is a significant difference between experiment class and a control class using t-test. To prove the hypothesis that there are significant differences in the teamwork skills and welding skills of students from the two study groups; the application of DT and PjBL models seen from sig. (2-tailed) should be lower than 0.05.

Result

Teamwork Skills Students

The result of assessment data of the teamwork skills students from the observer assessment was analysed to obtain the average score of the students on each indicator of teamwork skills in the experiment and control class. The results of the assessment are presented in Figure 5.

Figure 5. The average score of students' ability on each teamwork skills indicator on experiment and control class
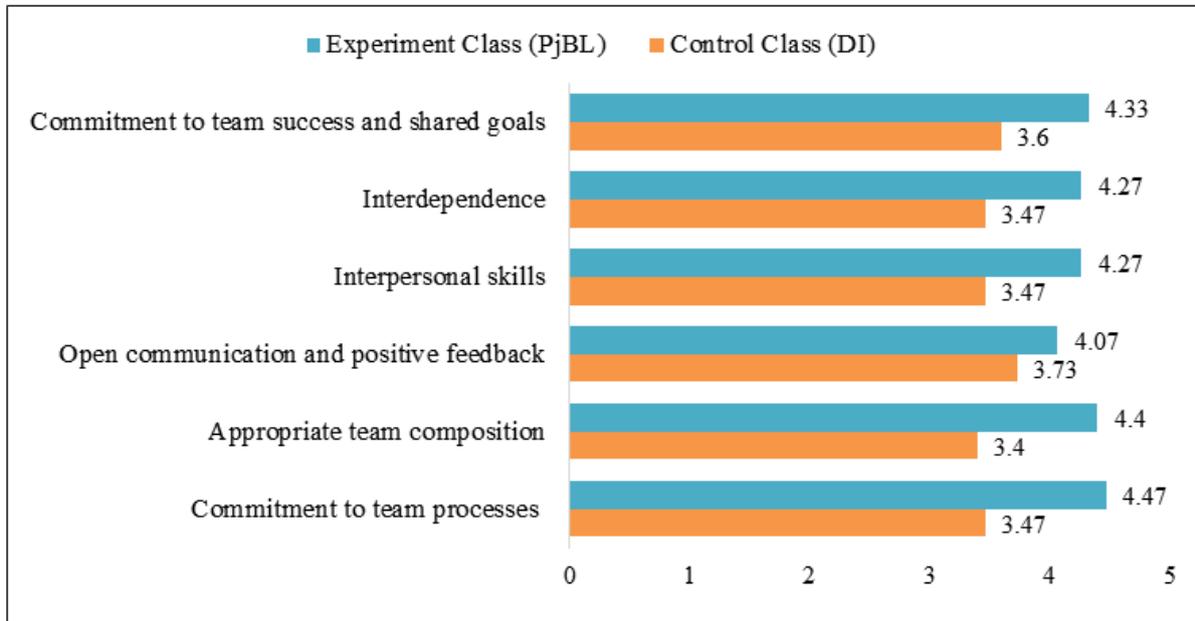
The analysis of normality, homogeneity and t-testing of the teamwork skills students' assessment results in experiment and control class is presented in Table 3.

**Table 3:** Analysis of normality, homogeneous and t-test teamwork skills students

| Factors | Normality | | | | Homogeneous | | t-test | |
| | Experiment (PjBL) | | Control (DT) | | | | | |
	Sample K-S	Sig.	Sample K-S	Sig.	Levene Statistic	Sig.	t	Sig.
Commitment to team success and shared goals	1.116	0.166	1.045	0.225	0.683	0.416	2,442	0.021
Interdependence	1.113	0.168	1.054	0.217	0.016	0.901	2.683	0.012
Interpersonal skills	1.113	0.168	1.089	0.186	0.788	0.382	2.435	0.022
Open communication and positive feedback	0.821	0.510	1.069	0.203	0.498	0.486	1.003	0.310
Appropriate team composition	1.261	0.083	0.756	0.616	1.523	0.227	3.147	0.004
Commitment to team processes	1.263	0.82	0.905	0.386	3.607	0.068	3.284	0.003
Total	0.573	0.897	0.810	0.527	2.973	0.096	9.366	0.000

The normality test results from the teamwork skills students' assessment data in Table 3 showing the Sig value. (2-tailed) on experiment class of 0.897 and control class of 0.527, both of which are higher than 0.05. This shows that the data from the assessment results are normally distributed. From the Levene statistic test, the significant level 0.096, and as the result of this test is higher than 0.05, it can be interpreted that the data has the same variance. Based on the results of the overall t-test on teamwork skills students, it can be concluded that there is a significant difference between experiment class and control class, with Sig. (2-tailed) 0.000. The five indicators consist of commitment to team success and shared goals, interdependence, interpersonal skills, appropriate team composition and commitment to team processes. An indicator that did not differ significantly (> 0.05) is on open communication indicators and positive feedback.

Welding Skills Students'

The result of assessment data as to the welding skills students from the observer assessment was analysed, to obtain the average score of the students on each indicator of welding skills in the experiment and control classes. The results are presented in Figure 6.

Figure 6. The average student score on each competency welding skills in experiment and control class
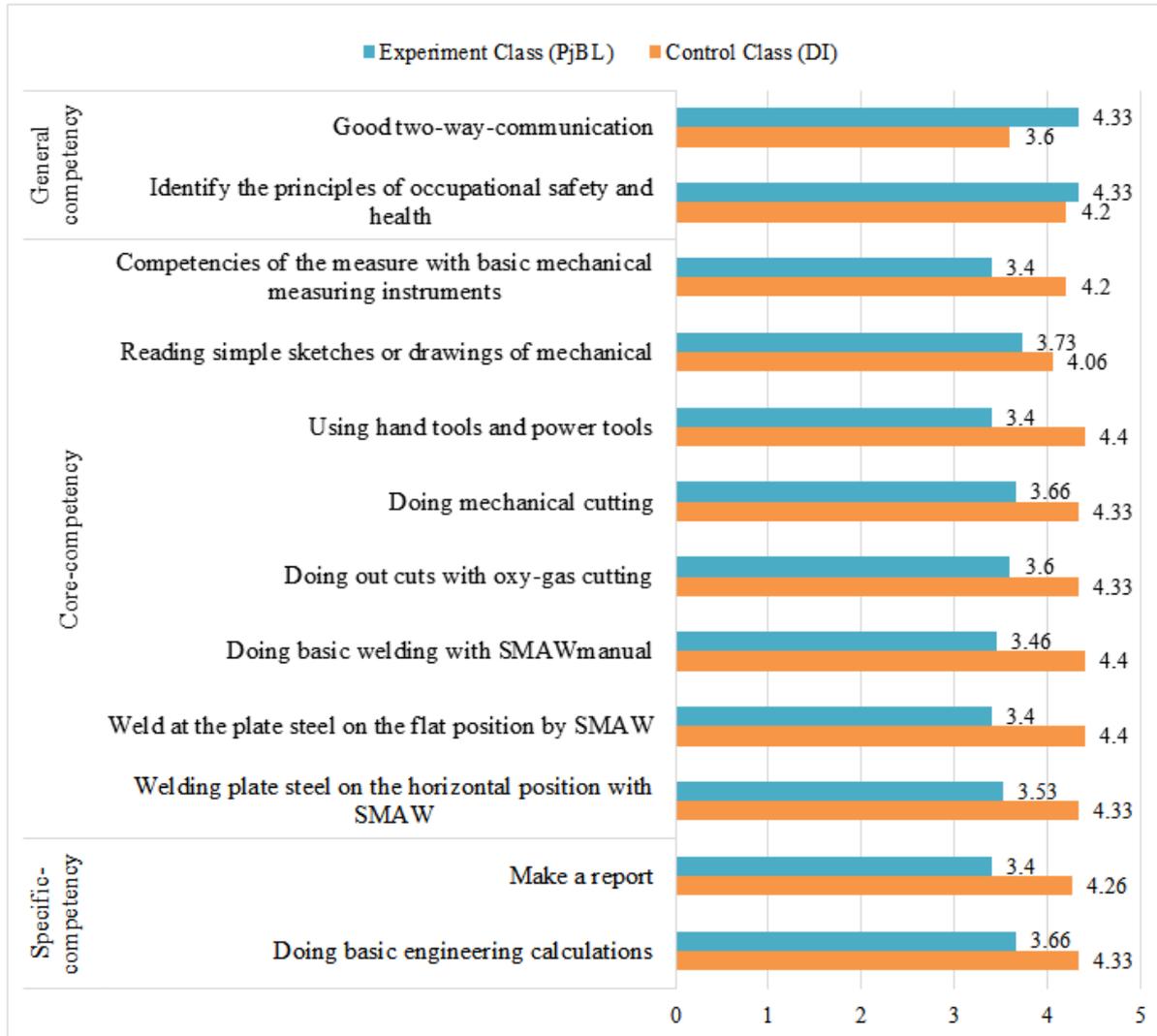
The overall average of welding skills students' in the learning activity based on the DT model is higher than the learning activities with PjBL. The results of the normality test using Kolmogorov-Smirnov, the homogeneity test using Levene statistic, and the t-test are presented in Table 4.

**Table 4:** Analysis of normality, homogeneous and t-test welding skills students

Category	Competency	Normality Experiment (PjBL) Sample K-S	Sig.	Normality Control (DT) Sample K-S	Sig.	Homogeneous Lev.-Sta.	Sig.	t-test t	Sig.
General competency	Good two-way-communication	1.116	0.166	1.045	0.225	0.683	0.416	2.442	0.021
	Identify the principles of occupational safety and health	1.116	0.166	0.965	0.309	0.018	0.896	0.487	0.630
Core competency	Competencies of the measure with basic mechanical measuring instruments	1.089	0.186	1.113	0.168	0.788	0.382	2.435	0.022
	Reading simple sketches or drawings of mechanical	1.069	0.203	0.821	0.510	0.498	0.486	1.033	0.310
	Using hand tools and power tools	0.756	0.616	1.261	0.083	1.523	0.227	3.147	0.004
	Doing mechanical cutting	0.905	0.386	1.263	0.082	0.303	0.587	2.029	0.052
	Doing out cuts with oxy-gas cutting	1.045	0.225	1.116	0.166	0.683	0.416	2.442	0.021
	Doing basic welding with SMAW	1.054	0.217	1.144	0.146	1.314	0.261	3.454	0.002
	Weld at the plate steel on the flat position by SMAW	0.959	0.316	1.144	0.146	4.407	0.145	3.147	0.004
	Welding plate steel on the horizontal position with SMAW	1.089	0.186	1.183	0.122	3.972	0.056	2.655	0.013

Specific-competency	Make a report	0.756	0.616	1.113	0.168	0.808	0.376	2.646	0.013
	Doing basic engineering calculations	0.905	0.386	1.263	0.082	0.303	0.587	2.029	0.052
Total		0.716	0.685	0.610	0.851	0.462	0.502	8.714	0.000

The result of the normality test by using the Kolmogorov-Smirnov test on value data from experiment class and control class obtained that all items have Sig value. > 0.05. Thus, it can be concluded that the data is normally distributed. Likewise, with a homogeneity test using the Levene statistic test, the result also obtained Sig value. > 0.05, thus it can be interpreted that the data has the same variance. In t-test analysis, there are four items of competence with Sig value higher than 0.05: identify the principles of occupational safety and health, reading simple sketches or drawings of mechanical, doing the mechanical cutting, and doing basic engineering calculations. For four items of this competence, there is no significant difference. Small sig value of 0.05 is in the competence: good two-way-communication, competencies of the measure with basic mechanical measuring instruments, using hand tools and power tools, doing out cuts with oxy-gas cutting, doing basic welding with SMAW, weld at the plate steel on the flat position by SMAW, welding plate steel on the horizontal position with SMAW and making a report. For eight items of this competence, there is a significant difference. Overall there is a significant difference in welding skills students between control classes. with the implementation of DT and experiment class with the implementation of PjBL.

A comparison of the mean scores of teamwork skills and welding skills from the two research classes is presented in Figure 7. In teamwork skills, the average student score in the experiment class is higher than the control class, whereas in the experiment class, the average score is 4.3, while the control class is 3.69. In welding skills, the average score of higher students is in a control class with an average of 4.28, whereas in the experiment class, the average value of students is 3.52.

Figure 7. The average comparison of teamwork skills and welding skills in experiment and control class
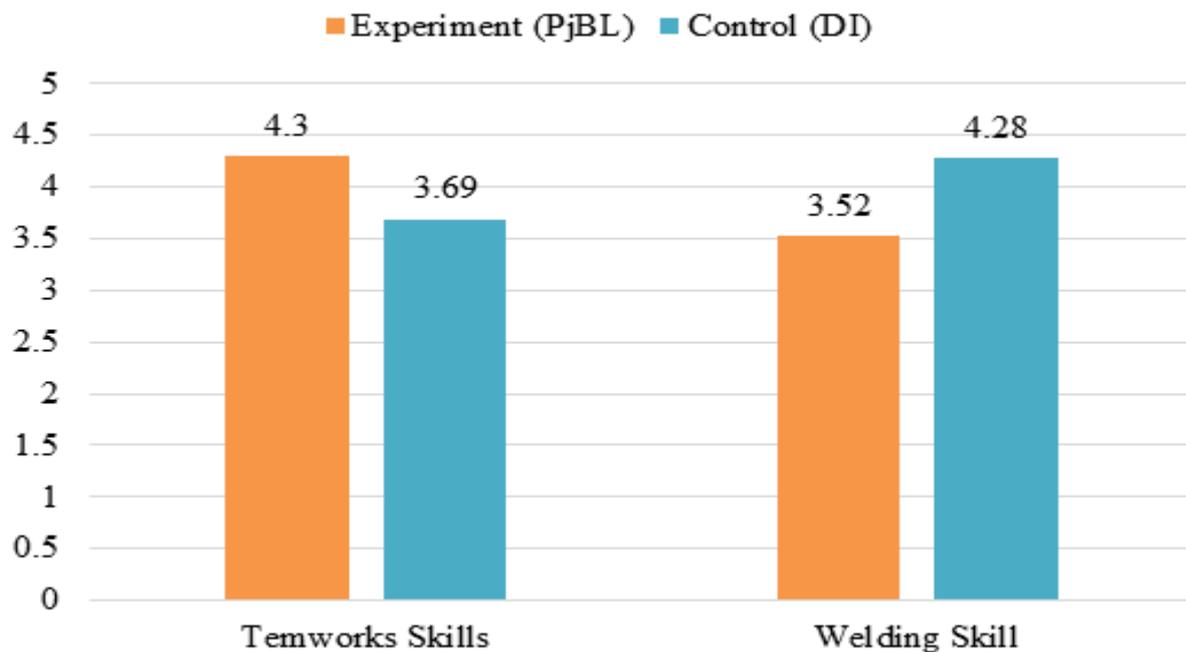
Discussion

The students in the experimental class with the implementation PjBL model have higher average teamwork skills, than the control class with the implementation of the DT model. The high assessment result of the observer for teamwork skills in this experiment class is based on the students showing good competence on all indicators of teamwork skills. As to the indicator of commitment to team success and shared goals, almost all students in the experiment class showed good things. For students, the task of this project belongs to them together and the project assignment is based on the real world, which makes them have a high motivation to solve it. This leads to the attachment of each student to the project task and attachment to his team-mates to help one another, resulting in a strong commitment to each student to accomplish the goal, which is the completion and success of their project tasks, namely the successful completion of their project tasks. A study by Francese et al. (2015) reveals that the high motivation of students in project-based learning is based on several properties, such as high student enthusiasm in developing products that are the task of the project, monitoring from teachers to direct students to work together during project tasks, teachers' continuous role in motivating students and providing advice on how to communicate, and competition between groups to present the best work.

Commitment to team success and shared goals does not look good in students in control classes based on the DT model. However, the study was designed so students study in groups (in Phase 5 in the application of DT model, students learn welding techniques in a conflicting

manner, see Figure 4) but each student tends to compete with fellow students in each group to improve their competence. Expectations of improved teamwork skills students' have not been solidly achieved with the implementation of this DT. However, to improve the personal competence of DT students, it is very appropriate to implement the model.

In the control class, the low willingness of students to achieve common goals is seen when a teammate has difficulty in developing and improving his competence. His team-mates are reluctant to help. This is a poor outcome, as the purpose of forming this group was for students to learn with their teammates. Observers also rate low on the second indicator in teamwork skill, which is interdependence. In experiment class learning activities implementing PjBL, each student in the group has a high contribution to achieve their team goals. They divide the tasks among all members of the group and help each other when teammates experience difficulties or problems with the assigned job. The colleague who has a problem is open to his teammates, honest about his shortcomings, and communicates well with his teammates to solve problems together. Students assisted by a friend of his group show respect for his helpful friend. It is also the basis of the observer to give high grades to students in the experiment class on the indicator of open communication and positive feedback. Based on study by Rodriguez (2015), project-based learning models have been shown to increase student interactions with both other students and teachers. Similarly, in the appropriate team composition and commitment to team process aspects, the PjBL students recognise the role of team members, by fully completing the assigned work portion of the team and in having a sense of responsibility for their contribution to the team.

A possible reason why teamwork skills in the experimental class, with PjBL implementation are higher than the DT control class, is the learning environment created from the student-centered learning approach, thus indirectly affecting (nurturant effect). This joint project task allows students to support each other and help their projects to work well. During project execution, many students get technical and non-technical problems, and the key to solving any problems found is teamwork. The students are aware of it, so teamwork to solve problems grows naturally in students.

In welding skills, the average grade of the control class is higher than the experiment class, and there are significant differences between the two classes. However, in welding skills, there are two competencies in which the average value of students is higher in the experiment class than the control class, namely good two-way communication and ability to identify occupational safety and health principles. The high average competence of good two-way communication is similar to the assessment of teamwork skill on the communications and positive feedback indicator. Students in the experimental class are able to communicate well with friends of one group, friends in other groups and teachers. In the competence of identifying safety principles of occupational safety and health, students in the experiment

class are better than the control class, because students get the opportunity to carry out project tasks from the real world, thus providing more real experience to students about safety principles.

In all core and specific competency categories, the students in the control class with the DT implementation are superior to the students in the experiment class with the PjBL implementation. Core competency and specific competency categories are the core competencies of welding skills. Higher grades of students in control classes with the implementation of DT models are expected by the various advantages of the DT model itself. The DT model is focused on the allocation of more time spent improving the core and specific competency of welding skills, while in experiment class with the PjBL implementation, less time is allocated to students to improve their core and specific competency welding skills, due to increase in the range of student teaching materials and the existence of project tasks. Another factor that makes the welding skills of students higher in the control class is the learning approach of the learning model. In learning with the implementation of the DT model of teacher-centred learning approach, teachers fully control and play an active role in learning activities.

Conclusion

Based on the results of this study, it can be concluded that different learning models implemented by teachers yield different learning outcomes owned by students. In the learning activity with the implementation of the project-based learning model, the average score of students on teamwork skill is higher than welding skills, whereas in the learning activity with an application of the direct teaching model, the average value of students on welding skills is higher than the teamwork skills. The factor that contributes to the different learning outcomes owned by the students is the learning environment created by the implemented learning model. In the learning activities with the implementation of a project-based learning model of learning, centred on the students, they learn together through the project tasks assigned to them. Every student has a strong attachment to their project assignments, which makes students work well together for successful projects. However, due to the increased scope of learning in the implementation of the project-based learning model, which has a project task, the learning time that is focused on welding technique skills is reduced, leading to low welding skills of students with the implementation of the project-based learning model.

In contrast, under the direct teaching model, a large time is reserved for the student to focus on learning and improving welding technique skill. The higher welding skills of students in learning activities with direct teaching model is also influenced by the dominant role of the teachers in controlling the learning (teacher-centred learning), so the instructional effect of the teacher is high enough to influence the high welding skills of the students. However, the

learning activities implementing direct teaching are not good enough in terms of teamwork skills. Students do not have strong attachments to fellow team members, and tend to compete in their group to increase their competence. Helping a team member who is experiencing difficulties, communication between members and commitment to team success is not seen in the students performing the learning activities under the implementation of this direct teaching model.

REFERENCES

ACNielsen Research Services (2000). *Employer Satisfaction with Graduate Skills.* Australia: Research Report Evaluations and Investigations Programme Higher Education. Retrieved from http://hdl.voced.edu.au/10707/67824

Ahmad, A., Kamin, Y., Minghat, A. D., Nordin, M. K., Farzeha, D., and Nabil, A. (2014). Vocational Teaching Method: A Conceptual Model in Teaching Automotive Practical Work. *World Academy of Science, Engineering and Technology - International Journal of Humanities and Social Sciences*, 8 (8) 2544 – 2547. https://doi.org/10.1999/1307-6892/9999060

Amri, S and Khoiru, L., A. (2010). *Proses Pembelajaran Kreatif dan Inovatif Dalam Kelas: Metode, Landasan Teoritis-Praktis dan Penerapannya*. Jakarta, Indonesia: PT. Prestasi Pustakaraya.

Arat, M. (2014). Acquiring Soft Skills ar University. *Journal of Educational and Instructional studies,* 4 (3), 46-51. Retrieved from http://www.wjeis.org/FileUpload/ds217232/File/09.arat.pdf

Arends, R.I. 2001. *Exploring Teaching: An Introduction to Education*. New York: McGraw-Hill Companies.

Ariratana, W., Sirisookslip, S., and Ngang, T. K. (2015). Development of Leadership Soft Skills Among Educational Administrators. *5th World Conference on Learning, Teaching and Educational Leadership (WCLTA 2014), Procedia - Social and Behavioral Sciences*, 186 (2015) 331 – 336, https://doi.org/10.1016/j.sbspro.2015.04.016

Bakar, M. A., et al (2013). Student Centered Learning Environment for Project Monitoring. *The 4th International Conference on Electrical Engineering and Informatics (ICEEI 2013). Procedia Technology,* 11 (2013), 940-949, https://doi.org/10.1016/j.protcy.2013.12.279

Bennett, S., Agostinho, S., & Lockyer, L. (2015). Technology tools to support learning design: Implications derived from an investigation of university teachers' design practices. *Computers & Education, 81*, 211-220, https://doi.org/10.1016/j.compedu.2014.10.016

Blik, H., Harskamp, E.G. & Naayer, H.M. 2014. *The Effects of Strategy Instruction versus Direct Instruction for the Education of Young Adults with Limited Intelligence.* Netherland: University of Groningen (GION).

Bovbjerg, K., M. (2006). Teams and collegiality in educational culture. *European Educational Research Journal*, 5 (3), 244-253. https://journals.sagepub.com/doi/pdf/10.2304/eerj.2006.5.3.244

Celik, S. and Vuran, S. (2014). Comparison of direct instruction and simultaneous prompting procedure on teaching concepts to individuals with intellectual disability. *Education and Training in Autism and Developmental Disabilities,* 49 (1), 127-144.

Francese, R., Gravino, C., Risi, M., Scanniello, G. and Tortora, G. (2015). Using Project-Based Learning in a mobile application development course-an experience report. *Journal of Visual Languages & Computing.* 31 (Part B), 196 – 205, https://doi.org/10.1016/j.jvlc.2015.10.019

Garreta-Domingo, M., Hernández-Leo, D., & Sloep, P. B. (2018). Evaluation to support learning design: Lessons learned in a teacher training MOOC. *Australasian Journal of Educational Technology, 34*(2), 56-77, https://doi.org/10.14742/ajet.3768

Hall, G. and Jones, H. L. (1976). *Competency-Based Education: A Process. For The Improvement of Education*. Englewood Cliffs, N. J.: Prentice-. Hall.

Hashim, M. H. M. (2015). The Practice of Employability Teamwork Skills. *International Journal of Vocational Education and Training Research*, 1 (2), 16-21, https://doi:10.11648/j.ijvetr.20150102.11

Hoegl, M. (2005) Smaller teams—better teamwork: How to keep project teams small. *Business Horizons*, *48,* 209-214, https://doi.org/10.1016/j.bushor.2004.10.013

Hua, Z. et al. (2011). Student autonomy and awareness: vocational education and student-centered learning in china. *Journal of Vocational Education and Training, 63* (2), 191-203, https://doi.org/10.1080/13636820.2011.566346

Hull, L., et al. (2016). Content validation and evaluation of an endovascular teamwork assessment tool. *European Journal of Vascular and Endovascular Surgery*, *52* (1), 11-20, https://doi.org/10.1016/j.ejvs.2015.12.044

Jabarullah, N. H., Jermsittiparsert, K., Melnikov, P. A., Maseleno, A., Hosseinian, A., & Vessally, E. (2020). Methods for the direct synthesis of thioesters from aldehydes: a focus review. Journal of Sulfur Chemistry, https://doi.org/10.1080/17415993.2019.1658764.

Junrat, S. et al. (2014). Soft Skills for University Library Staff in Thailand. *International conference on education & Educational Psychology 2013. Procedia-Social and Behavioral Science,* 112 (2014) 10027-1032, https://doi.org/10.1016/j.sbspro.2014.01.1265

Johnston, J., Loyalka, P., Chu, J., Song, Y., Yi, H., and Huang, X. (2015). The Impact of Vocational Teacher on Student Learning in Developing Countries: Does Enterprise Experience Matter?. *Comparative Education Review*, Vol 60 (1) 131 - 150. https://doi.org/10.1086/684360

Karakus,M and Töremen, F. (2008),"How our schools can be more synergic: determining the obstacles of teamwork", *Team Performance Management*, 14 (5) 233 – 247, http://dx.doi.org/10.1108/13527590810898509

Kardi S. (2001). *Seri Model Pembelajaran Fisika SLTP*. Jakarta, Indonesia: Depdiknas

Koparan, T and Guven, B. (2014) The Effect on the 8th grade Students' Attitude towards Statistics of Project Based Learning. *European Journal of Educational Research*. 3 (2) 73-85.

Lau, P., et al. (2014). Developing Students' teamwork skills in a cooperative learning project. *International Journal for Lesson and Learning Studies,* 3 (1), 80-99, http://dx.doi.org/10.1108/IJLLS-03-2013-0018

Lick, D.W. (2000). Whole-faculty study groups: Facilitating mentoring for school-wide change. *Theory into Practice*, 39 (1), 43-49, https://doi.org/10.1207/s15430421tip3901_7

Matteson, M. L., et al (2016). "soft skills": A Phrase in Search of Meaning. *Portal: Libraries and the Academy* 16(1), 71-88. doi: 10.1353/pla.2016.0009 Retrieved from https://digitalcommons.kent.edu/slispubs/73.

MoEC. (1992). Keputusan Menteri Pendidikan dan Kebudyaan. No.0490/U/1992. Sekolah Menengah Kejuruan. Jakarta, Indonesia: the Indonesian Ministry of Education and Culture.

MoMT. (2007). Keputusan Menteri Tenaga Kerja dan Transmigrasi Republik Indonesia No Kep. 342/MEN/X/2007 Tentang Penetapan Standar Kompetensi Kerja Nasional Indonesia Sektor Industri Pengolahan Sub Sektor Industri Barang Dari Logam Bidang Jasa Industri Pengelasan Sub Bidang Pengelasan SMAW. Jakarta, Indonesia: the Indonesian Minister of Manpower and Transmigration.

Munawaroh (2017). The Influence of teaching Method and Learning Environment to the Student's Learning Achievement of crat and entrepreneurship subject at vocational high school. *International Journal of Environmental & Science Education*, 12 (4) 665-678.

Mustapa, M, A, S, Ibrahim, M. and Yussoff, A. (2015). Engaging vocational college students through blended learning: improving class attendance and participation. *4th World Congress on Technical and Vocational Education and Training (WoCTVET), 5th–6th November 2014, Malaysia, Procedia- Social and Behavioral Sciences,* 204 (2015) 127-135, https://doi.org/10.1016/j.sbspro.2015.08.125

Nelson, K., Kift, S., Creagh, T & Quinn, C. 2013. *Teamwork Guide*. Sydney: Southern Cross University.

Pachauri, D., & Yadav, A. (2014). Importance of soft skills in teacher education program. *International Journal of Educational Research and Technology*, 5, 22-25. Retrieved from http://www.soeagra.com/ijert/ijertmarch2014/5.pdf

Ramlan, R. and Ngah, S. (2015). Student Perception on the Importance soft skills for Education and Employment. *PEOPLE: International Journal of Social Sciences,* 1 (1), 696-708. Retrieved from https://www.grdspublishing.org/index.php/people/article/view/390/371

Republic of Indonesia. (2012). Peraturan Presiden Republik Indonesia No 8/2012 tentang Kerangka Kualifikasi Nasional Indonesia. Jakarta: President Republic of Indonesia.

Rodrigues, J., Simavilla, A. L., Cura, J. M. d., Ezquerro, J. M., Lapuerta, V. and Gracia, M. C.(2015). Project based Learning Experiences in the space Engineering Education at Technical University of Madrid. *Advances in Spaces Research*, 57 (7), 1319 – 1330, https://doi.org/10.1016/j.asr.2015.07.003

Rongraung, S. et al. (2014). Soft Skills for Private Basic Education School in Thailand. *International conference on education & Educational Psychology 2013. Procedia-Social and Behavioral Science,* 112 (2014) 956-961, https://doi.org/10.1016/j.sbspro.2014.01.1254

Sanjaya, W. (2006). *Strategi Pembelajaran, Berorientasi Standar Proses Pendidikan*. Jakarta: Kencana Prenada Media Group.

Seat, E. et al (2001). Enabling Engineering Performance Skills: A Program to Teach Communication, Leadership, and Teamwork. *Journal of Engineering Education*, 90 (1), 7-12, https://doi.org/10.1002/j.2168-9830.2001.tb00561.x

Setiawan, A. and Soenarto. (2017). Relevansi Kompetensi siswa Teknik Audio Video dengan Kompetensi Yang Dibutuhkan Industri di Kabupaten Bantul. *Journal of Vocational and Work Education*, 1 (1), 14-25. Retrieved from http://journal.student.uny.ac.id/ojs/index.php/JoVWE/article/view/6963/6899

Shih, W. L, & Tsai, C. Y. (2017). Students' perception of a flipped classroom approach to facilitating online project-based learning in marketing research courses. *Australasian Journal of Educational Technology, 33*(5), 32-49. https://doi.org/10.14742/ajet.2884

Sudjimat, D. A. (2016). Implementation Of Project Based Learning Model In Mechanical Machining Skills Package Of Vocational High School, *Proceedings of the International Mechanical Engineering and Engineering Education Conferences (IMEEEC 2016), AIP Conference Proceedings* 1778, 030024 (2016), 1-7, https://doi.org/10.1063/1.4965758

Tarricone, P. & Luca, J. 2002. Successful teamwork: A case study. in Quality Conversations. *Proceedings of the 25th HERDSA Annual Conference, Perth, Western Australia, 7-10 July 2002. 640-64.*

Tapscott, D., & Williams, A. (2010). *Macrowikinomics*. New York, NY: Penguin.

Tucker, R. and Abbasi, N. (2016). Bad Attitudes: Why design students dislike teamwork. *Journal of Learning Design*, 9 (1) 1-20. Retrieved from https://www.jld.edu.au/article/view/227/233.html

Wallapha, A. (2012). *Document for organizational development*. Educational Administration, Faculty of Education, Khon Kaen University.

Williams, E. A. and Duray, R. (2006). Teamwork orientation, group cohesiveness, and student learning: a study of the use of teams in online distance education. *Journal of Management Education*, 30 (4), 592-616. https://doi.org/10.1177/1052562905276740

Wulandari, B., Et al (2015). Peningkatan Kemampuan Kerjasama Dalam TIM Melalui Pembelajaran Berbasis *Lesson Study*. *Journal Electronics, Informatics, and Vocational Education (Elinvo),* 1 (1), 9-16.

Xinyan, X. (2016). The application of "project based learning" in higher education computer course. *2nd International Conference on Education Technology, Management and Humanities Science (ETMHS 2016). Published by Atlantis Press*, 310-313. https://doi.org/10.2991/etmhs-16.2016.69