Collaborative teaching-learning between college and industry: A case study of steel practice subject matter in the technical faculty of Yogyakarta State University

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Abstract: *In vocational secondary school, a collaborative teaching-learning model is known as a dual education system where the students practice in industries. Generally, that system is successful although there are variations among the school. Such collaboration needs relatively high cost and complicated coordination. As an alternative, teaching-learning collaboration between college and industry can be conducted by inviting guest lecturers from the well industry. The present study is aimed at obtaining a model where practice products are marketable and students have co-operative attitudes in team work. Three teaching-learning models are compared. First, the teaching-learning process of the first half semester is conducted by a lecturer in college while the rest is conducted by two lecturers in industry. Second, as the first, but the teaching-learning process takes place in college only. Third, the teaching-learning process is conducted in college and without collaboration. Students are divided into small groups of 3 or 4 to make marketable products. The products are measured by some college aspects according to industrial standards, whereas co-operative attitudes are measured by Johnson and Johnson definition. The results are subjected to nonparametric statistic analyses. In perspective of the practice product, the first teaching-learning model does not differ significantly from the teaching-learning second model ($t = 2,2$; $p > 0.05$); but differs significantly from the third ($t = 4.5$; $p<0.01$); the second teaching-learning model differs significantly from the third ($t = 3.7$; $p<0.01$). In perspective of the co-operative attitudes, the first teaching-learning model does not differ significantly from the second ($t=0.81$; $p>0.05$). The guest lecturer model is able to produce marketable products and well co-operative attitudes in a team work.*

Keywords: *collaborative teaching-learning model, well industry, dual education system, guest lecturing, practice products, co-operative attitudes, team work*

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1. Introduction

a. Background

The development of information technology and globalization, special in manpower, becomes more and more competitive so that it gets harder for one to get work. This does not only happen in this country, but also in other countries in the world. In Aceh, for example, there is a big demand for labor for building projects, but a lot of Indonesian workers are not qualified to work in these projects. Similarly, competition in education in preparing labor is tough. In fact, there are schools and colleges from abroad. In Central Java, for example, there are schools, from kindergarten to senior high, that have all the facilities including good boarding houses. These are schools funded from overseas. In five years, perhaps, there will be a foreign university in Semarang (*Kompas, 2 April 2005*).

It seems that most Indonesian workers are of general competencies, such as hydro-civil, civil-structure, etc. Meanwhile, the conditions for labor require more special competencies, such as hydro-irrigation, steel structure, concrete structure, bridge structure, etc. In this situation, as embryos to specialists, the school of engineering needs to intensify the teaching-learning programs in subject matters which can be develop into specialties. One of these subject matters is steel practice. This can be an embryo to get specialization in steel structure. For this, the school needs to search efficient and effective teaching-learning strategies in order for the students to be interested in this case and be able to get a certificate of specialty. Such study is very important in order to get national standards or international standards with competence certificates. In the long run, it is expected that Indonesian workers will be able to compete in the labor market of civil building in Indonesia which has lately been dominated by foreign labor. The purpose of the present study is to endeavor the steel product unit which will contribute to the significance of the existence of the civil department, assist finance, and improve quality and relevance of education.

b. Problems

The problems in this study are related to the search for the collaboration teaching-learning models between college and industry which will produce efficient and effective learning strategies in the steel practice subject matter. This is also related to look for strategies that will clear the way to product units.

c. The Study Objectives

1) To search for a collaborative teaching-learning model between college and industry which is efficient and effective in co-operative learning strategies for the steel practice subject matter.
2) To clear the way of product units in the department of civil technique and planning education of the faculty of engineering.

2. Literature Review

a. Teaching-Learning Collaboration between Colleges and Industries

Education is the three-fold responsibility of the government, family, and society. Collaboration among colleges and industries will be one form of the realization of this

concept. The United States collaborative education model, for example, is one such phenomenon which has been developed by Pontin and Fettis in the year 1993 (Sulastri, 2004). In the same way, Nursid (1998) states that along the life, human beings will not get out of the society, earn the life, and have been influenced by social environment, called the society. Similarly, Nasution (2000), states that the learning process does not only happen in classroom, but also outside of the classroom. The resource-based learning theory (learning based on sources) shows that the implementation of learning is very wide. Those concepts are all in agreement that pupil learns with something, with an amount of learning sources individually or in groups, with activity learning. In this learning, pupils learns in class, laboratory, library, special learning sources, or anything outside of the classroom.

In collaborative teaching-learning model, students can get real experiences, attitudes, and see the fact that learning sources are in industries. Students will be motivated to know deeper what they do not yet know. That will improve their knowledge. Communications among students and industry personnel will enable them to work in industry where they collaborate.

There are three types of collaborative teaching-learning. *First*, students learn in part in colleges and in part in industries using different of hour number and class pattern. The dual system education program of the vocational high school, for example, is conducted by way of hour-release, day release, or block release or any combination of these (Wardiman, 1998). *Second*, students learn in college only. In this case, the lectures come from both industry and college. This pattern varies in duty, authority, and competences of the industrial personnel. *Third*, the collaborative teaching-learning is a combination of these two types.

Untung Sukaryadi (2007), on an implementation seminar of MoU among education institutes and industries, stated that education training institute can optimize the teaching-learning process by the concept of training-base products. This concept is able to improve the students' skills as well as increase the welfare of the educational institutes as well as that of the personnel. The fact is that many students who practice in industries merely become watchers; they do not directly work because of limitation of appliance, space, and instructors (*KR*, 26 April, 2007, p.14).

Therefore, to get an effective and efficient teaching-learning process, the implementation of students' practices is conducted in two alternatives. *First,* the students' practices are not conducted entirely in the industries, but in part in colleges. *Second,* lectures and instructors from industries collaboratively teach, but the practices are entirely conducted in campus. Both alternatives have their advantages and disadvantages, but those are better than no collaboration at all. The first alternative, for example, gives the marketed competencies, the practice result is better, and students have the actual experience. But, the cost and program coordination are highly complicated.

b. Cooperative Learning Strategies

The co-operative learning is at first developed by Blaine which is based on the contention that a class consists of a variation of abilities. Basically, co-operative learning is not competition, but it is learning centered on student and mastery learning. This learning strategy emphasizes students' cooperation in completing a project or working in small groups, enabling the learning result attainment on groups to be equal with that of the individuals (Kindsvatter, et.al, 1996). Then, Burden (1999) states that co-operative learning means putting students into small groups, joining abilities in group learning. The teacher

gives a group the problems to be completed. Students co-operate in the group, assist each others, criticize and praise one another, and accept group values.

According to Goor & Schween (1993) there are five formats used in a model of co-operative learning: (1) Student Team-Achievement Division (STAD), (2) Think-Pair-Share (TPS), (3) Jigsaw, (4) Team Accelerated Instruction (TAI), and (5) Group Investigation (GI). Of these co-operative learning modes, STAD (Student Team-Achievement Division) has been selected as the most convenient to be used in the present study. This mode is considered to be the most compatible applied in steel practice. Meanwhile, the other co-operative learning strategies would be more suited for the learning of theories.

c. Research Framework

Learning objectives, theory and practice, is influenced by students' motivation. A great variety of techniques can be used to motivate students. External motivation can affect internal motivation which will arise by collaborative learning among colleges and industries, both in the case of the place of practice and the instructors from industries.

The teaching-learning of steel practice conducted through collaborative learning by colleges and industries will not only give the learning results in the form of marketable practice products but it will also nurture cooperative attitudes. Students who practice in industries will have a lot of actual learning sources such as industrial products, working atmosphere, and industrial conditions. In this, students will automatically respond in the form of knowledge, inspirations, and vision. If the learning sources are positive, then the students will adopt positive responses. In addition, the more learning sources, the more are students motivated to learn. Thus, students who have high learning motivation will opt to achieve the learning objectives. In this case, the learning objectives are marketable products and cooperative attitudes.

Collaboration among instructors from college and industries will give new good condition such as the learning sources brought in by industry instructors. In this case, students who perceive the instructors' competencies will be motivated to work enthusiastically. Another thing, students will be ashamed if they do not work hard because they formally have a higher academic status than people from the industry. All these will motivate students to practice in a high measure of spirit. The highly-motivated students will allow co-operative learning to form professionalism attitudes in them.

In conclusion, collaborative learning offered by college and industry can improve the quality of practice products as well as cooperative attitudes in students. This applies to both the model where students practice at industries and the model where guest instructors come to campus.

d. Hypothesis

1) Collaborative teaching-learning strategies where students practice at industries (that is, Model 1) will be able to give to the students marketable practice products and professional attitudes.
2) Collaborative teaching-learning strategies where industry instructors are invited to campus (Model 2) will be able to give to the students marketable practice products and professional attitudes.
3) Learning outcome resulting from collaborative learning Model 1 will not differ significantly from collaborative learning Model 2.

4) Learning outcome resulting from collaborative learning Model 1 will differ significantly from no collaboration in Model 3.
5) Learning outcome resulting from collaborative learning Model 2 will differ significantly from no collaboration in Model 3.

3. Research Method

a. Research Design

This study is aimed at finding the collaborative teaching-learning model that is effective and efficient to achieve learning outcomes. For this, this study is experimental in design. The three teaching-learning models are compared. *First*, The teaching-learning process of the first half of the semester is conducted by the lecturer in campus while the remaining half is conducted by two instructors in industry. *Second,* as the first, but the teaching-learning is done in campus only. *Third,* the teaching-learning process is conducted in campus and without collaborative actions. The figure below is the chart describing the research design.

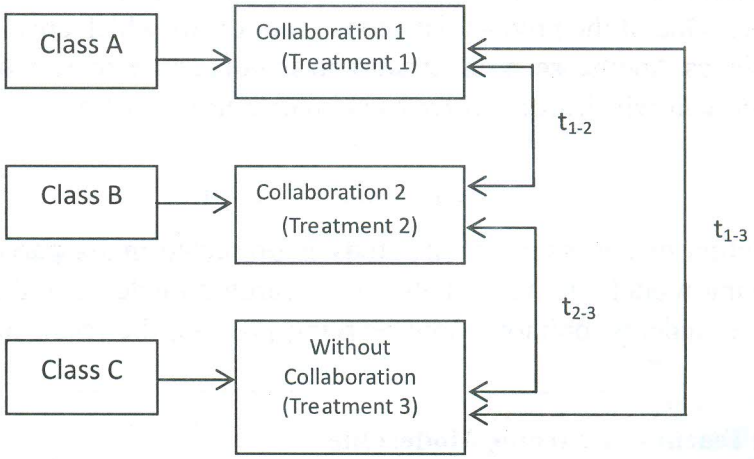

Figure I: The Research Design.

As shown in this chart, Class A receives treatment one (collaborative model one) and Class B receives treatment two (collaborative model two). These are conducted in action research steps. Meanwhile, Class C receives treatment three, as a control group, which is a regular teaching-learning process.

b. Data Collection

The teaching-learning models one and two are done during the second half of the semester. There are four cycles of action research with two meetings for each cycle. The lesson planning of teaching-learning activities consists of the following parts: industry instructor, model of collaboration, student treatments, substances of teaching, appliances and practice materials, schedule, and monitoring sheets. Two instructors take each of the teaching-learning practice sessions, one from the college, and the other from the industry who holds documents of experiences and certifications. The students are divided into small groups of about three or four people to make products. In each teaching-learning cycle, the students

activities are observed and recorded by using the monitoring sheets. In the last cycle, evaluation and reflective activities are done and the results are used as a basis for the following cycle. Treatment of the co-operative teaching learning activities consists of (1) positive interdependence, (2) face-to-face interaction, (3) individual accountability, (4) social skill, and (5) group processing (Johnson and Johnson in Burden, 1999).

c. Setting of the Study

Two workshops are used as the research venues, in accordance to the design of the study. The first venue is the steel workshop of the Civil Engineering Education Department of the Technical Faculty of Yogyakarta State University. This is the campus setting. The second venue is the workshop of *C.V. Gracia* Steel Industry that is located at a plant area around the minutes from the campus. This is the second setting.

d. Data Analysis

There are two data sets in this study, one related to processes and the other to products. The process data are taken by observation through the monitoring sheets and are analyzed by descriptive statistics. One of the product data consists of chairs which are analyzed and by nonparametric statistics. Another set product data consists of cooperative learning attitudes in the form of behavior scale which are analyzed by nonparametric statistics.

4. Results

The description of the results of the study is presented in six parts. They are the collaborative learning model one, the collaborative learning model two, the conventional learning model, the students' opinion about learning process, the result of analysis, and discussion of the results.

a. Collaborative Teaching-Learning Model One

1) The observation of cooperative learning

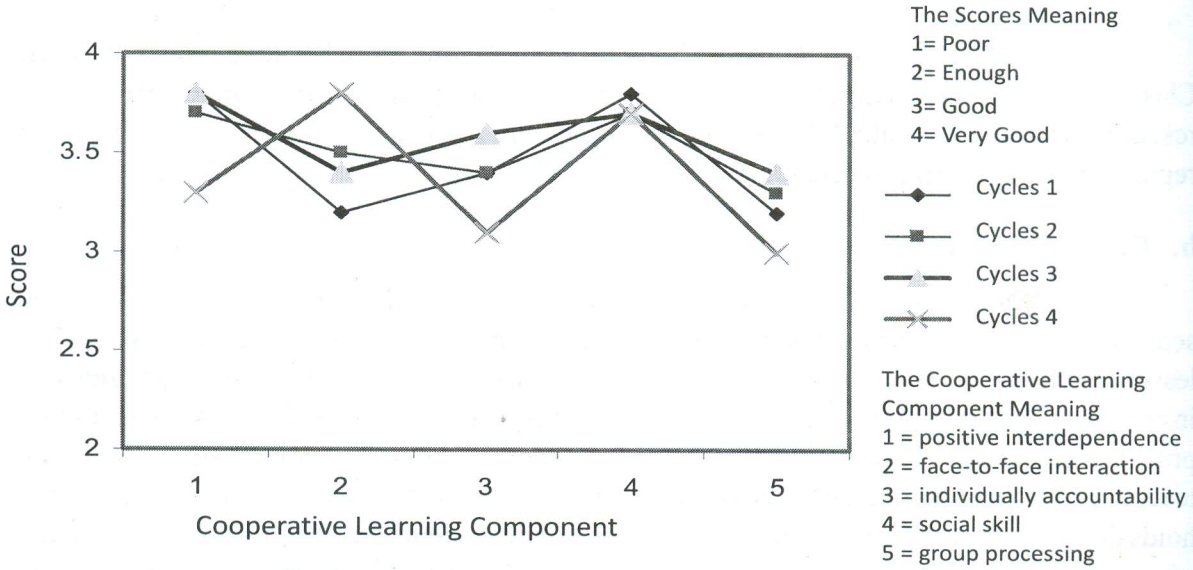

Figure 2: The Observation Result of Cooperative Learning Model One

2) The practice products

The students practice product in industry is chair furniture. In short, every assessment element almost entirely in categorize A. According to concept co-operative learning assessment, the each group member has equal score. The following table is illustrated that results.

Table 2: **Scores of the Students' Who Practice in Industry**

Number	Group	Score	Letter Score	Score Weight
1	I	94	A	4
2	II	83	A-	3.75
3	III	85	A-	3.75
4	IV	90	A	4
5	V	90	A	4
6	VI	92	A	4
Sum				23.5
Mean				3.91

b. Collaborative Teaching-Learning Model Two

1) The observation of cooperative learning

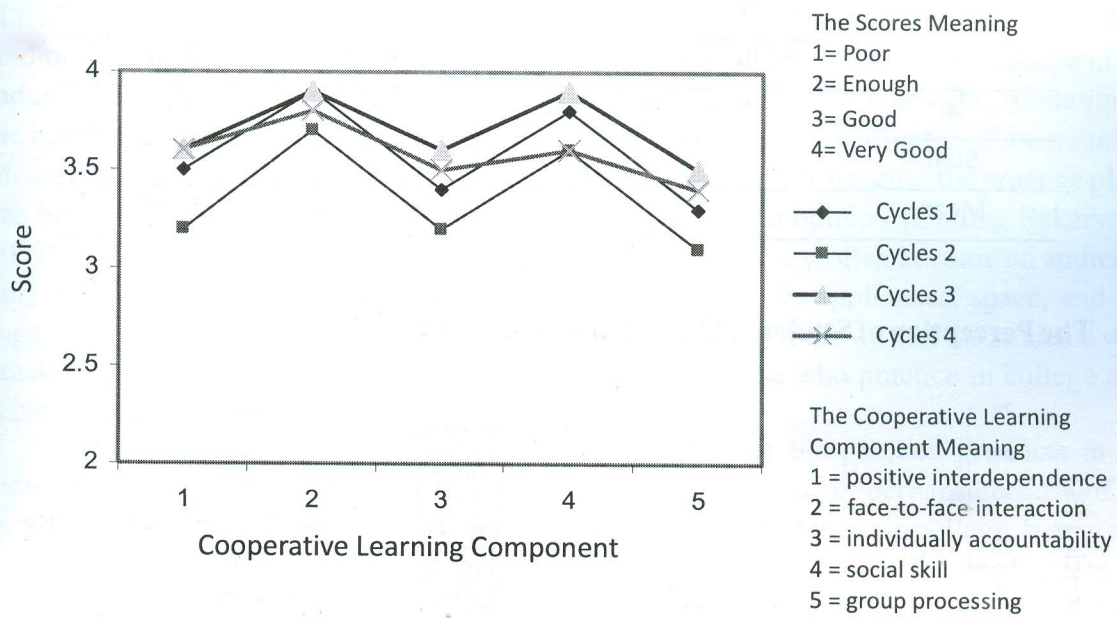

Figure 3: The Observation Result of Cooperative Learning Model Two

2) The Practice Products

The students practice products in the industry are chairs. Every assessment element of these products is almost entirely in the A category. According to concept co-operative learning assessment, each group member has an equal score. The following table is illustrates that result.

Table 3. **Scores of the Students' Who Practice in College**

Number	Group	Score	Letter Score	Score Weight
1	I	85	A-	3.75
2	II	83	A-	3.75
3	III	86	A	4
4	IV	81	A-	3.75
Sum				15.25
Mean				3.81

c. The Learning Conventional Products (Non-Collaboration Model)

Table 4. **Scores of the Students' Who Practice in College (Learning Conventional)**

Number	Group	Score	Letter Score	Score Weight
1	I	75	B+	3.25
2	II	76	B+	3.25
3	III	74	B+	3.25
4	IV	80	A-	3.75
Sum				13.50
Mean				3.375

1) The Perception of Students About The Place of Practice

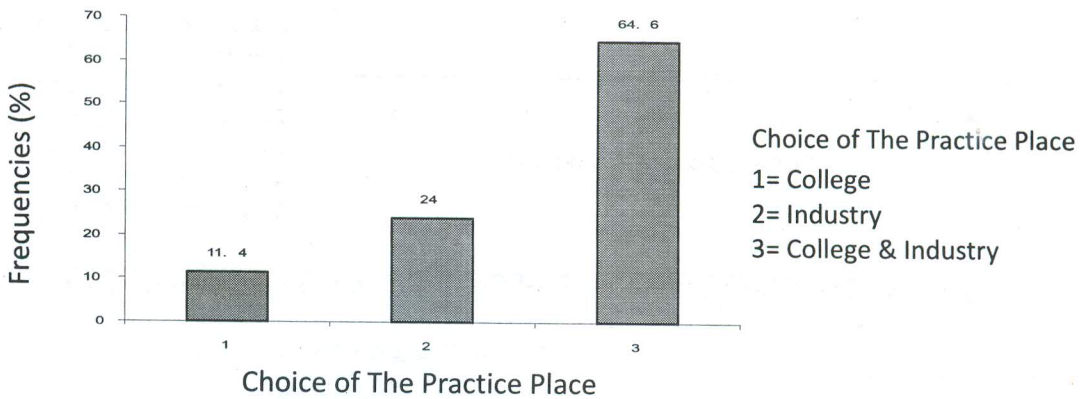

Figure IV: The Perception of Students about The Place of Practice

e) The Practice Product Comparison Analysis among Learning Models

Table 5. **Resume of Data Analysis**

Number	Comparasion	?-Coefficient	t-Coefficient	Probabilities	Comment
1	Collaboration Model One, Collaboration Model Two, and Non-Collaboration Model Together	24,8		P<0,01	Significant
2	Collaboration Model One and Collaboration Model Two		2.2	P>0,05	Non-Significant
3	Collaboration Model One and Non-Collaboration Model		4.5	P<0,01	Significant
4	Collaboration Model Two and Non-Collaboration Model		3.7	P<0,01	Significant

f. Discussion

The collaborative model one, in which the students practice in college and industry, has excellence in the case of quality of practice results (mean score = 3.91). Meanwhile, the collaborative model two, in which the students practice in college only, has a mean score of 3,81. However, the data analysis results do not show significant difference. In the same way, the cooperative learning outcome in the form of attitudes does not show significant difference. In the other words, this study indicates that in the light of practice products and attitude outcomes, there is no significant difference between Model 1 and Model 2. This finding seems to be factual. There is possibility that some of the students who practice in the industry may not be able to make use of their maximum capacity due to possible limitation in the number of appliances, the space for the practice work, and the instructor of the industry. Meanwhile, the students in college make possible to practice fully because the practice place has been designed to do house all these activities. The same opinion (Untung Sukaryadi, 2007), backs up this fact in that students who practice in industry often become an audience only with limited opportunity to practice due to limitation in appliances, space, and the supervisor (*KR*, 26 April, 2007, p.14). However, the finding still shows that the students who practice in industry become component of students and those who practice in college also achieve a high level of performance.

In the questionnaire data, the students reported that the practice products in the industry are better than those in college. These circumstances occur perhaps because of the fact that some finishing equipments in the industry are better than those in college. It may also seem possible that the students' perception is related to the fact that the products in the industry are directly for sale. In this case, the students perceive that the practice process in college is poorer although the instructors are the same the practice products must be for sale too. It seems, thus, that the industrial atmosphere brings students in the real work situation so that they work seriously and learn by seeing how an industry operates.

However, the industry scheme often faces complicated problems. For one, it is not easy to co-ordinate lecturers, students, and industrial activities. Often times, the industry would only admit some students adding to the difficulty of coordination. In these conditions, the learning process is not controlled well. Another problem is related to the fact that it is not easy to get partner industries. This needs a lot of struggle on the part of the students and the college. At times, industries have a lot of job orders in which case it is easier for students to come in. At other times, there is scarce work such that they may need to ease workers out. This is when it is difficult for the students and the education institute to get partner industries. Finally, the cost that students must cover to join the industrial practice is not cheap. Most of the time, the industry wants to get advantage so that all materials and instructors' fees must be paid for by the college. In addition, students may have to spend extra expenses for transportation if they find themselves practicing in places far from campus.

On the contrary, collaboration Model Two (students practice in college) is cheaper than collaboration Model One. The collaborative coordination is simpler and the industry instructors can be chosen well. If, for example, the industry instructor is not as expected, the college can ask for a replacement even in the middle of a learning practice. If the college is well-supported by adequate equipments and collaboration with the industry runs well, the learning outcome will be able quite equivalent to that of Model One. Even, the unit products will be operate by the teaching-learning model two.

In this study, the students' preference for practice venues is quite indicative. College practice (Model Two) receives a rating of 65% while the industry model (Model One) 35%. For the reasons as stated above, students seems to think that the college model is not as expensive as the industry model with quite equivalent qualities of learning outcomes.

Finally, among the three modes of practice programs, the study results indicate that the collaborative teaching-learning models one and two are better than the conventional teaching-learning model (Model Three). That is so perceivable since, in the students' opinion, the industry instructors' competencies become a determining factor in producing quality learning. Working with qualified instructors, students will have high motivation to work seriously so that cooperative learning process runs well and, consequently, produces quality practice products.

5. Conclusion and Suggestion

a. Conclusion

Pursuant to the study results presented above, the following items of conclusion can be drawn.

1) The collaborative teaching-learning Model One (the practice conducted in the college and in the industry) is able to improve the quality of marketable practice products, the mean score being 3,91 (scale 4). However, this model needs the tight coordination of time, energy, and cost. Co-operative learning is achieved well. Students' motivation in doing the practice is high. Most students (65%) choose this mode of practice.
2) The collaborative teaching-learning Model Two (the practice conducted in college only by inviting in industry personnel) is able to produce marketable practice products, the mean score being 3,81 (scale 4). This outcome occurs despite the limited supply of finishing appliances. This collaborative model is more conducive to achieve learning co-

operative outcomes the Model One is. Students' motivation in doing the practice is distinctively high.

3) There is no significant difference in both the practice products and in students' attitudes between the teaching-learning Model One and the teaching-learning Model Two ($t = 2.2$; $p>0,05$).
4) There is a significant difference in practice products between the teaching-learning Model One and the teaching-learning Model Three (the conventional model) ($t=4.5$; $p<0,01$).
5) There is a significant difference in both the practice products and in students' attitudes between the teaching-learning Model Two and the teaching-learning Model Three (the conventional model) ($t=3.7$; $p<0,01$).

b. Suggestion

The study results indicate that the second model of practice collaborative teaching learning processes does not differ significantly the first model. Despite the fact there are advantages and disadvantages between the two model of teaching, the researcher suggests that the teaching-learning of steel practice be done following the second model. That is, instructional activities are carried out in campus inviting industry personnel as co-lecturers. This way, the coordination, cost, and implementation problems can be minimized.

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