

# INDUSTRY PARTNERSHIPS LEARNING MODELS FOR SURVEYING AND MAPPING OF VOCATIONAL HIGH SCHOOLS

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## ABSTRACT

This study aims to identify a learning involving the world of work, to formulate the learning model, and to evaluate the learning model. This study used a qualitative approach for design and development research, consisting of the development and validation steps. The study concludes as follows. (1) the learning through partnerships having been conducted in all vocational high schools were industrial practice and vocational practice examination. (2) the constraints of learning through partnerships were mainly the far distance and the industry schedules that did not always match with the school's. (3) the model development could be done by improving the learning quality by industrial practices in the private companies and with adding the learning model by industry visits, guest teaching, and up-to-date technology training. (4) the implementation of the developed model showed the feasibility and the effectiveness to prepare the students with the competencies required by the world of work. (5) the learning models through partnerships that could be practiced were guest teaching, orientation for industrial practice, industrial practices, students' industry visits, up-to-date technology training, and vocational practice examination.

**Keywords:** school-industry partnerships, surveying and mapping program, vocational high school learning

## INTRODUCTION

The surveying and mapping workforces consist of at least three levels, namely bachelor degree experts, diploma degree technicians, and vocational high school graduated operators. The existing 63 vocational high schools conducting the Surveying and Mapping program in Indonesia (Dit PSMK, 2013) have not been able to fulfill the needed operators. On the other hand the graduates of the program find difficulties to enter the work field. The gap could be caused by incapability of vocational high schools to response the needs of the surveying and mapping world of work.

The surveying and mapping works include three steps, namely data collections, data processing, and data presentation. The technological progress for data collection is marked by the broader digital-electronic equipment, for data processing by the broader computer uses, and for data and information presentation in digital formats.

The technological development marked by the uses of new equipment and working

procedures, is generally difficult to be adapted by the schools. The modern digital electronic equipment often cannot be repaired more than 10 years from the manufacture, whereas purely mechanical-optical instruments have an operating life of 30 years or more (Rueger, 2006). Therefore the schools need to establish partnerships with the world of work that is quicker in responding such progress because of the work efficiency and effectiveness demands.

The world of work requires the competencies of data and information collection, data and information management, information presentation, and professional performance. Preparing the graduates with such competencies, especially those are related to the professional performance, cannot rely on the learning in the schools only.

There are various learning models through partnerships with the world of work, with various intensities from guest speakers in schools and students' industry visit, to working experience in industry (Davis and Snyder, 2009). Rogers (1996) described some learning models involving the world of work, namely:

(1) Mentoring, industry practitioners guide the students in industries, so the students gain the experience of the world of work. (2) Industry practitioners speak to the students about their jobs and the needed educational and training. (3) Job-shadowing, the students observe, ask, and learn about career opportunities on the actual work sites. (4) Cooperative education, the students get on-the-job training. (5) School-sponsored enterprises, the students provide services or produce goods for sale and the world of work help to run the program. School-industry partnerships allow running various learning model with the content relevant to the need of the world of work, such as industry practitioners as guest speakers, industry visit, school-based enterprises, job-shadowing, mentoring on the work sites, and industry working experiences such as work practices and apprenticeships.

Hughes, et al. (2002) researched the activities, the motivation of the industries, and the benefits of the partnerships. The activities include industry practitioners as advisory board members and helping internships, the industries provide learning experiences to the students such as mentoring, work site visits, and job-shadowing (Hughes, et al., 2002).

Hughes, et al. (2002: 382) discovered the company's motivation to participate in partnerships, namely contributing to education and community, improving company images, fulfilling employee shortage, and building a client base. The benefits of the partnerships for the schools are funding for school activities, reviewing the curriculum, internships, and offering the students to practice their skills (Hughes, et al., 2002: 387). The students gained benefits such as work experiences on the workplace, industry practitioners as a source of support and role models for students.

Velde (2009) showed that 67% managers were willing to provide working practice places, 38% wanted to involve in collaboration with schools, 29% willing to provide the student working experiences, and 15% interested as guest speakers. In China the

learning of the vocational high school students involving the world of work was generally conducted three times, namely a one week visit on the first year, working practices of a one month on the second year, and a half year on the third year (Lai and Lo, 2008).

Otherwise Taylor (2006) showed the weakness on the industry side felt by the schools in an apprenticeship activity on a construction industry. The apprentices were treated as cheap workers, needed if the workload was above the capacity of the employees and doing the most undesirable duties of the workers. The workers were busy with their own duties, therefore it limited in guiding the apprentices. The apprentice participants had to take initiative for themselves and just imitated whatever the workers did. The productivity pressures limited the learning quality in the industry.

In Indonesia the researches of the learning of vocational high school students through partnerships with the world of work were related to the implementation of the dual system education. Although there were very broad activities could be included, Wahyu Nurharjadmo (2008) showed that the dual system education was thought to be limited to the industrial practice.

Bukit (2002: 530) also showed that the teachers interpreted the dual system education as the industrial practice. The first year students who had not mastered the basic skills were not involved in the production work, but they were only directed to observe (Bukit, 2002: 532). The students having been placed in the production works even still dominated the repetition and monotonous works, therefore the industrial practice had not sharpened the students' knowledge and skills (Bukit, 2002: 532-533).

Bukit (2002: 538) explored the dual system education on the Metal Processing program of the vocational high school that was close and had an access to a manufacture industry, identified two problems needed to be further researched. First, it needed to be

discovered how to determine the competencies should be learned in industry and in school. Second, it needed to be discovered how the dual system education applied to the vocational high schools far from the industries.

The benefits of industry partnerships were felt more in the learning related to new technologies, as explained by Jestrab, et al. (2009). The characteristics of new technologies are marked by a lack of textbooks, the learning materials have not been developed, and a lack of teacher expertise. To overcome these difficulties, the industry experts could be involved in the learning development and as guest speakers.

Stokes (2008) presented the partnerships with industries on the career centers in the United States of America, running the vocational education for the high school students. The research result showed that there were mutual dependencies between schools and the world of work. The schools needed the relevant learning and the resources of teachers, materials, and equipment. The world of work needed competent human resources provided by the education to support the work operational successes.

Stokes (2008) discovered the reasons of schools for partnerships, namely: (1) keeping curriculum and learning relevancies, (2) enhancing the students' learning experiences by involving guest teachers from industries, simulating the world of work, industry visit, job-shadowing, and work practice, and (3) obtaining cheaper materials and equipment. According to this research, the schools had some criteria to determine the industry partners, namely relatively close to the schools, the practitioners being graduated from a vocational education, and the field relevant to the school's program.

Stokes (2008) also showed the industry motivation in partnerships, namely: (1) the industry practitioners graduated from vocational education felt advantaged by their education, so they wanted to contribute to the schools, (2) there was a will to serve the young well

prepared to enter the world of work with relevant learning, and (3) they hoped to recruit competent graduates to work in their industries.

Pilz (2009) in Great Britain and Germany discovered that a main factor affecting the industry to participate in vocational education was industry's costs and benefits. The costs spent by the industries included the guider costs and learning materials. The obtained benefits were such as the student worked half-time, the workforces were available in the long run, and the students adapted to the industry cultures so they would be more loyal when they would be workers.

Dhillon (2007) presented two key characteristics for effective and sustainable partnerships between schools and industries, namely trust and goal sharing. The levels of the trust from the lowest to the highest were calculation-based trust, experienced-based trust, and instinctive trust. The schools and the industries need to share their goals, because it is difficult to achieve their own goals attempted by one party only.

Based on those researches, school-industry partnerships benefit both parties. The benefits for industries include the availability of the competent workforces, the fulfillment of social responsibility, and improving company positive images. The benefits for schools are such as the learning relevant to the industry requirements and enhancing students' learning experiences. The learning models through industry partnerships are such as guest teaching, industry visit, job-shadowing, mentoring, internships, and apprenticeships. The keys for sustainable partnerships are the trust and the goal sharing between schools and industries.

The research problems were as follows. (1) How is the existing learning involving the surveying and mapping industries? (2) How is the model of the learning involving the world of work? (3) How is the implementation of the model of the learning involving the world of work? This research aimed to: (1) identify the existing learning involving the surveying and mapping industries, (2) formulate a model of

learning involving the surveying and mapping industries, and (3) evaluate the implementation of the model of the learning involving the world of work.

This research results could provide theoretical and practical benefits. The theoretical benefit is enriching scientific treasury of the learning for the surveying and mapping through school-industry partnerships. The practical benefits are as follows. (1) For the vocational high schools, as an input to run the learning responsive to the needs of the world of work. (2) For the students, to achieve the competencies needed by the world of work easier. (3) For the surveying world of work, to accommodate their needs. (4) For the government, to solve the problem of workforces by bridging the gap between the need and the availability of the workforces.

## METHODS

This study used a qualitative approach. The qualitative method was chosen because the researcher tried to understand the meaning or experience of the people by meeting them in the field and gathering what they did and they thought. That was difficult to be gathered by quantitative methods. This study was included as a case study research and conducted in more than one school, could be stated as a multiple case design. A multiple case is not the same as multiple respondents, but a replication design. In a replication design, a report of each case is arranged, and then all researched cases are combined.

Determining criteria to select research places is a beginning of purposive sample selection, so purposive sampling is also stated as criteria based selection. The arranged criteria reflected the research goals and guided identification of information-rich cases. The criteria arrangement in sample selection applied an ideal case selection strategy. The most ideal profiles of vocational high schools conducting surveying and mapping program were arranged. Based on school credibility, the vocational high

schools viewed as excellent were selected by the aspects of sufficient student numbers, accredited as A, and ISO 9001:2008 certified. Based on the implementation of the learning involving the world of work, the selected vocational high schools had the broadest industry partners related to the work fields, geographical distribution, and the existing learning through partnerships. The school accessibility was considered by the ease of the researcher to enter the research setting.

The study started in the selected vocational high schools using the above criteria. Three state vocational high schools or Sekolah Menengah Kejuruan Negeri (SMKN) were selected, namely SMKN 2 Yogyakarta in Yogyakarta Province, SMKN 2 Purwokerto in Central Java, and SMKN 1 Nganjuk in East Java. From these three schools, the research continued to the field studies in the industry partners of the related schools.

The study object was the learning of the vocational high school students of the surveying and mapping that its implementation directly involved the surveying and mapping world of work. The object of this study included: (1) the existing learning, (2) the constraints in involving the world of work in the student learning and the alternatives to overcome them, (3) the alternatives to develop the learning model involving the world of work, (4) the implementation of the learning model involving the world of work, and (5) the arranged and revised learning model involving the world of work.

The study subjects were the vocational high school students and teachers of the surveying and mapping program, and the practitioners of the surveying and mapping industry partners in the student learning. The students being the research subjects were who had done or were doing the industrial practices. The teachers being the research subjects were who were the advisers of the industrial practices or the assessors of the vocational practice examination for the last two academic years. The practitioners being the research subjects

were the practitioners of the surveying and mapping world of work who were the industrial practice advisers or the external assessors of the vocational practice examination.

This study applied the procedure of the Design and Development Research (DDR) according to Richey and Klein (2007). The DDR research procedure uses a qualitative approach allowing the researcher to get a clear understanding of what happened, why it happened, and the thought and belief of the research subjects. This study included the model development and validation steps. The model development step included literature study, field study, and the learning model formulation.

The field study in the vocational high schools and the surveying and mapping world of work used a qualitative approach. The formulated learning model was submitted to the teachers and the industry practitioners to gather their opinion. This step was needed to evaluate the feasibility and effectiveness of the formulated learning model.

The model validation step included the learning model implementation, expert review, and revision based on the analysis of the implementation. The learning model development was implemented in the three researched schools to assess its feasibility and effectiveness. Before the learning implementation, a need assessment of the students was conducted by in-depth interviews and questionnaires. During the implementation, observation to the learning process was conducted. After implementation, in-depth interviews to the students, teachers, and industry practitioners, open questionnaires to the students, and document analysis were conducted to evaluate the feasibility and effectiveness of the learning model.

The effectiveness of the learning model was evaluated by output analysis referred to the competencies achieved from the learning. The criteria for the effective learning model were the students achieved knowledge, skills, and attitudes required to work as a surveying and

mapping operator. The students, teachers, and industry practitioners were asked about their opinion. The data of the teacher and industry practitioner opinion were collected by in-depth interviews and the students' opinion by in-depth interviews and open questionnaires. The data were used to revise the model.

Open questionnaires were given to the students to collect data of the learning need and implementation. The open questionnaires were given before the learning implementation to inventory the students' need to the learning and after the implementation as evaluation materials to further model development. The triangulation was done by analyzing the different data sources and collection methods. The triangulation of data sources was done by testing the data truth from the different research subjects, namely teachers, industry practitioners, and students, and the analyzed documents. The triangulation to the data collection was conducted by testing the data truth gathered by in-depth interviews, participant observation, and document analysis.

The research data were collected as field notes, interview and observation notes, interview records, learning activity photos, document analysis notes, and questionnaire results. The data analysis is tracking and arranging the research data making possible the researchers move to the research findings (Bogdan and Biklen, 2007: 159).

The data analysis techniques included data reduction, data display, and verification. These three data analysis techniques were not done sequentially, but simultaneously, interactively, and iteratively. The analysis started at the data being collected, the data reduction even had been designed before by arranging categorization to anticipate the abundant collected data.

The categorization strategy in this research was mainly by coding. In this research the categorization was based on the research objects. Beside as a reference in the data reduction, the categorization was also as a reference in data display and verification. The

data analysis was done by organising the data and looking for patterns, and data interpretation was done by describing and making thinking frames related to the theory, action, the importance of the research findings, and making them easy to be understood (Bogdan & Biklen, 2007: 159). The data interpretation was presented in the discussion of the research results by developing ideas of the research findings and relating them to the existing references and the broader interests and concepts.

## RESULTS AND DISCUSSION

The existing learning involving the surveying and mapping world of work having been done in the researched schools were industrial practice, vocational practice examination, students' industry visit, guest teaching, and orientation for industrial practice. Table 1 presented that industrial practice in the government institutions especially the Land National Agency or Badan Pertanahan Nasional (BPN) dominated the three researched schools.

Table 1. Student Distribution in Industrial Practices (in %)

School	Academic Year	BPN	Other Government Offices	Private Companies
SMKN 2 Yogyakarta	2010/2011	74	26	0
	2011/2012	72	6	22
SMKN 1 Nganjuk	2010/2011	68	17	15
	2011/2012	60	11	29
SMKN 2 Purwokerto	2010/2011	35	59	6
	2011/2012	58	42	0

The industrial practices involved very few private companies. SMKN 2 Yogyakarta had only partnered with PT Berau Coal for two to five students and PT Jelajah Survey Konsultan (JSK) for three students. SMKN 1 Nganjuk partnered with PT Angga Anugrah Konsultan (AAK), PT Cipta Suramadu Konsultan (CSK), and PT Data Terra Surveitama (DTS). Eight students were accommodated by PT AAK and five students by PT DTS.

The industrial practices in the researched schools benefited both the world of work and the students. The world of work obtained additional workers, when the work volume exceeded the human resource capacity of the industry. The students obtained the work experiences relevant to the subjects learned in the schools. After knowing the application of the learned subjects, the students' learning enthusiasm increases. The industrial practices in the private companies benefited the students more than that of the government institutions. The students achieved more comprehensive competencies and financial supports from the companies. The financial supports covered transportation, accommodation, and pocket

money. The other benefit was the opportunity to be recruited as new employees after graduation.

The students who did their industrial practices in PT Berau Coal and PT JSK had a chance to improve the work competencies in the real surveying and mapping fields and to operate the up-to-date technologies. The students also received financial supports from the companies. In PT JSK, the transportation and accommodation costs in the fields and lunch in the offices were provided by the company. In PT Berau Coal, the transportation and accommodation costs were fully funded by the company and the students were still given pocket money.

The students did the industrial practices in PT AAK, PT DTS and PT CSK had an opportunity to work in the real surveying and mapping fields. In PT DTS, the students also learned to operate the up-to-date technologies. In these three private companies, the transportation and accommodation costs also fully funded by the companies and the students were also still given pocket money. The research results of the students doing industrial practices in the private companies showed that

the companies put a trust to the students to do their surveying and mapping projects. The students were trained for three to six first days, and then they were trusted to work using the equipments previously not learned and not available in the schools. This was different to a research by Bukit (2002: 532-533) that the students did only repeated and tend to be monotonous works, so it had not sharpened the students' competencies.

The students' industry visit by SMKN 2 Yogyakarta and SMKN 2 Purwokerto had given an opportunity to the students to gather broader knowledge of the surveying and mapping world. The Geospatial Information Agency or Badan Informasi Geospasial (BIG) had been a visited object by these two schools. The students of SMKN 2 Purwokerto also visited PT Exsa Internasional.

By the industry visits, the students obtained the knowledge of the surveying and mapping scopes and technologies. They obtained new knowledge and view of the surveying and mapping world not yet learned in the schools, such as the working methods in the surveying and mapping industries and the much more sophisticated equipment than those in the schools. This knowledge could increase the students' spirit and interest to learn the surveying and mapping subjects.

The results were different compared to Lai and Lo (2008) that in China the industry visit generally could be for one week. The student visit in BIG and PT Exsa internasional were only about two hours, because of the limited accommodation budget caused by the industries being far from the schools.

The learning model of guest teaching by industry practitioners had been done in SMKN 2 Yogyakarta. The work experiences presented by the guest teacher gave the students the knowledge and the view of the surveying and mapping works.

The knowledge obtained by the students from the guest teaching were: (1) the management of the surveying and mapping works, (2) the management of time, workforce, and equipment, (3) the methods to work in the various natural and social conditions, (4) the methods to socialize with the communities in

the work locations, and (5) the methods to communicate to the concerned parties. The knowledge could support the subjects of the Work Safety and Health, the Customer Need Identification, and the Surveying and Mapping Budgeting Plan.

This study is in accordance with Hughes, et al. (2003: 378) that most industries were ready to accept the students' visits and the industrial practices. PT Exsa Internasional accepted the visit and PT JSK sent its staff to be guest teachers in the vocational high schools. Some companies accepted the students to have their industrial practices and the students were given more facilities than that of the government institutions.

The industrial practices in the private companies had more advantages than that in the government institutions. However the private companies tended to accept the students who were ready to work only, so it did not need too much training. Beside this, the work locations were often too far from the schools, so it limited the role and opportunity of monitoring and supervision by the teachers. Therefore the schools had to prepare their best students to have industrial practices in the private companies.

Different with the government institutions that their work schedules were easier to be predicted, with the private companies there was more difficult to synchronize the schedule of industrial practices with the work schedules. The private surveying and mapping companies are service providers, so when there is or there is not a work depends on the consumers that need such services. Therefore the companies could or could not accept the students, depend on when there was or there was not a work in accordance with the schedules of industrial practices.

The private companies actually wanted the students in their industrial practices to do the surveying and mapping projects, because the companies had trained the students on their first arrivals until they were ready to work. However, there was sometime a constraint because the consumers could be disappointed if their projects done by the students. Therefore the companies should be careful in determining

in which projects the students could be involved. The projects that could involve the students were those that the schedule was relatively loose and the clients had been permanent consumers for years, so they were fully trusting to the companies, as a described by the leader of PT JSK as follows.

“There are constraints to involve the students doing the projects. The biggest constraints are the tight working schedule and the clients’ trust to the work executors that have still been as students. The company should select the projects with relatively loose schedules and the clients have been very trusted to the company credibility.”

This research is in accordance with a research by Taylor (2006) that the productivity pressures limited the learning quality in industries. The opportunity of the students doing their industrial practices to do the surveying and mapping projects had to be limited to the projects which had relatively loose schedule and the clients had been very trusted to the company, so they would not be disappointed knowing their projects done by the practicing students.

The private companies wanted the time span from the industrial practice to the student graduation being not too long, so it would make easier to recruit the selected students to work in their companies. Too long time span could cause the competencies already mastered by the students decreasing. To solve this problem, the industry practitioners proposed the up-to-date technology training to equip the students prior to their graduation.

The industry visit could enrich the students’ knowledge of the surveying and mapping world. However the industries reasonable to be visited tended to be in the big cities such as Jakarta and Bandung, so the students had to spend the transportation and accommodation costs for such visits. This constraint could be handled by giving an early information, for example when the class promotion to XI Year and the implementation prior to class promotion to XII Year.

In SMKN 1 Nganjuk being farther from those cities, such industry visits had not been

implemented. This was caused by the more expensive transportation cost than that from Yogyakarta or Purwokerto. Therefore an alternative of closer visited location was needed, such as in the regions of East Java, Central Java, or Yogyakarta Special Province.

The students’ industry visits could give a broader view of the world of work. However there was a constraint to provide a complete view of the world of work. In the visited institution offices it could only be shown the processing and presentation data steps. The data collection step was done outside and far from the offices. Therefore the view of the data collection was presented by photos or videos accompanied by oral presentation and discussion or questions and answers.

This research is in accordance with a research by Velde (2009) that 67% of the industry managers were ready to give the work practice places for students, but only 15% interested to visit the schools as guest teachers. This was proven that a well programmed guest teaching had not been implemented in the researched schools.

The learning model was developed by improving the quantity or quality of the learning through the school-industry partnerships. There were two alternatives to develop the learning model, namely adding the learning that had not been conducted and improving the quality of the learning that had been conducted.

In SMKN 2 Yogyakarta, the learning model that had not been and there was an opportunity to be conducted was the up-to-date technology training with the instructors and equipment from the world of work. The idea to try this learning model was obtained from the practitioners in the institution where the students had their industrial practices and that sent its staff to be a guest teacher.

The technological progress supported by the progresses of electronics, computer, and satellite technologies will continually happen. At this time, the most urgent training to be conducted is the measurement using total station. Explicitly or not the vacancies of the surveying and mapping operator workers require the applicants being capable to operate



total station, and the schools generally have not have such equipment.

The training was proposed for the students who would be graduated soon, so they could practice in the real works soon. This was based on the input from the industry practitioners when the students did their industrial practices in their companies.

In SMKN 2 Purwokerto it could be developed the learning model of guest teaching. The students hoped to broaden their views of the surveying and mapping world of work directly from the practitioners. The development of the existing learning model was mainly the industrial practice in the private surveying and mapping companies. Currently the students of SMKN 2 Purwokerto had their industrial practices in the government institutions and gained less optimal competencies of surveying and mapping.

In SMKN 1 Nganjuk it could be developed the learning model of industry visit. Considering the transportation cost, the visited object was attempted not too far from Nganjuk. The schools' consideration in determining the industry partners was in accordance with a research by Stokes (2008: 100-101), namely relatively close to the schools and relevant to the study program. SMKN 2 Yogyakarta and SMKN 2 Purwokerto conducted their industry visits in Bogor and Jakarta. SMKN 1 Nganjuk being farther than the two schools would conduct a visit for the surveying and mapping industry in Yogyakarta, not too far from Nganjuk.

The developed learning models were: industrial practices in the surveying and mapping companies for SMKN 2 Purwokerto, an industry visit for SMKN 1 Nganjuk, up-to-date technology training for SMKN 2 Yogyakarta, and a practitioner guest teacher from the surveying and mapping world of work in SMKN 2 Purwokerto. The implementation of the learning models could conclude that the developed models were feasible to be implemented. The industry practitioners, the teachers, and the students thought that such learning models needed to be continued for the next years. In SMKN 2 Purwokerto on the 2012/2013 academic year the industrial

practices in the surveying and mapping companies started to be implemented. Five students did industrial practices in PT Exsa Internasional, Jakarta. The industrial practice in this company was as a follow up of the last three year industry visits in the company.

On the 2012/2013 academic year SMKN 2 Purwokerto shifted the schedule of the industrial practice from the beginning of semester 5 (Grade XII) to the middle of 4 (Grade XI). Therefore on this academic year there were two periods of the industrial practices, namely on the beginning of semester 5 for Grade XII students and on the middle of semester 4 for grade XI students.

On the industrial practice for the Grade XI students, the number of students doing industrial practices in the private surveying and mapping companies increased from five to nine. Five students did their industrial practices in PT Exsa Internasional and four students in PT JSK, Yogyakarta. The industrial practice in PT JSK was implemented as a follow up of the guest teaching activity by the company.

Doing industrial practices in the private surveying and mapping companies, the students obtained more complete work experiences. The students also obtained the benefits being not obtained in the government institutions such as: (1) the accommodation and transportation were provided by the companies, (2) they really worked as surveying and mapping operators, (3) they learned the competencies being difficult to be achieved in the government institutions such as the Customer Need Identification, (4) they directly interacted with various profession levels, namely: operator, technician, and expert, (5) they adapted to various surveying and mapping technologies, and (6) they adapted to various surveying fields and locations.

The industrial practices in the private companies were proven to be more effective in equipping the students with the more comprehensive work experiences than that in the government institutions. The students really experienced the real works. The facilities provided by the companies proved that the company gave rewards for the students as incentive for their works. The facilities included

the costs of transportation, accommodation, consumption, and pocket money.

This study is in accordance with a study by Pilz (2009) that main factors affecting the industries to participate in the student learning were the costs and the achieved benefits. The company gave facilities to the students doing industrial practices equivalent to their contribution to the company. As an example, PT Exsa Internasional was ready to accept the students to have industrial practices whenever they needed. When there was a project could be done by the students, they would be given money for their food. When there was not any project could be done, however they would only learn and would not be given money for food.

This study was also in accordance with a research by Stokes (2008: 100-101) that the industry practitioners graduated from the vocational high school of the surveying and mapping program were more motivated to participate in the learning and wanted to recruit the competent graduates. Although from another school, the production manager in PT Exsa Internasional had an educational background of such vocational high school program. An employee of PT JSK was also graduated from such vocational high school program. The practitioner in PT AAK was also a graduate of SMKN 1 Nganjuk. Both PT JSK and PT Exsa Internasional also participated in student learning motivated to recruit the students after graduated.

SMKN 1 Nganjuk having not conducted a visit to the surveying and mapping industry, on the end of the 2011/2012 academic year conducted a visit to PT JSK. The visit enriched the student knowledge of the surveying and mapping world of work. As a follow up of the visit, there were opportunities to conduct the visits for the next years. Beside this, PT JSK was also ready to accept the students of the school to have industrial practices. In the 2012/2013 academic year, there were 10 students of SMKN 1 Nganjuk had their industrial practices in this company.

By the visit, the students obtained knowledge about: (1) the professional performance having to be owned by surveying

and mapping workers, such as: honest, precise, tidy, discipline, tough, enthusiastic, responsible, and highly committed, (2) the scope of the surveying and mapping works, (3) the capability to adapt to the technological progress and various measurement field conditions, (4) the enrichment of the knowledge and view of the surveying and mapping, and (5) the management of the surveying and mapping works.

The industry visit was proven to be effective to broaden the students' view of the surveying and mapping world of work. The students obtained the knowledge of the surveying and mapping technological progress. The visit could broaden the view of various surveying and mapping work fields, so the view of the profession in the surveying and mapping fields would be clearer.

On the 2012/2013 academic year, SMKN 2 Purwokerto invited two guest teachers from PT JSK. By the activity of the guest teaching by the surveying and mapping industry practitioners, the students obtained the knowledge about: (1) the career in surveying and mapping world of work, (2) the modern surveying and mapping technological progress, and (3) A view of how a surveying and mapping surveyor works.

The effectiveness of the guest teaching was actually like that of the industry visits. By the guest teaching activity, the students also obtained the knowledge of the surveying and mapping world of work from the practitioners. Like that of the industry visit, the students also felt they needed a follow up activity of up-to-date technology training. As a follow up of the guest teaching, similar activities were planned to be conducted on the next years. Besides that, on the 2012/2013 academic year, four students had their industrial practices in the company.

This study was in accordance with a research by Velde (2009) that the industry practitioners were ready to accept students to have industrial practices more than coming to schools as guest teachers. The guest teachers from PT JSK coming to SMKN 2 Purwokerto directly stated their readiness to accept students to have industrial practices in their companies. On the contrary the practitioner of PT Exsa

Internasional having accepted the students' visits and industrial practices, had not been ready to be a guest teacher. This could be understood because the practitioners needed to spare a certain time to be a guest teacher compared to receiving the visits and guiding industrial practices that did not need to leave their daily works.

The students of SMKN 2 Yogyakarta participated in an up-to-date surveying and mapping technology training on the end of the 2011/2012 academic year in PT JSK. The most urgent up-to-date technology training was the training to operate total station. This technology had been usually used in the world of work, while the schools generally had not had it. By this training, the students obtained the knowledge, skills, and attitudes needed to work as a surveying and mapping operator. The knowledge had been achieved included: (1) the working principles of the equipments of the up-to-date surveying and mapping technology, (2) the processes from the collection to data processing using such up-to-date technology, (3) the general knowledge of the surveying and mapping, and (4) the surveying and mapping project management.

The skills achieved from the training included the skills of using the up-to-date surveying and mapping equipments and processing the measured data. The students participating in the training obtained the skills to operate the measurement equipment of total station. The skills to operate total station included the methods to set up, adjust, and use to measure traverses and situation details. The skills of processing measured data included analyzing the measured data and drawing the measurement results.

By the training, the students could also develop the attitudes needed to work in the surveying and mapping sectors. The developed attitudes were discipline, honest, hard-working, enthusiastic, tough, patient, professional, and working as it be. To be honest is mainly required in data collection. This study was in accordance with a research by Dhillon (2007) that the keys of the effective partnerships were the trust and the goal sharing. After the students of SMKN 2 Yogyakarta had industrial practices

in PT JSK, the company gave a chance for students to participate in the free of charge up-to-date technology training. After some times received the visits of the students of SMKN 2 Purwokerto, PT Exsa Internasional was ready to accept the students to have industrial practices.

After received the students of SMKN 2 Purwokerto to have industrial practices, PT JSK also accept the students to participate in the up-to-date technology training in the company. After the students of SMKN 1 Nganjuk visited to PT JSK, the company also gave opportunities for students to get their industrial practices.

This study also supported a research by Stokes (2008) about the mutual inter-dependencies between the schools and the world of work. The schools needed the industries for student learning and the industries needed the schools to recruit the competent workers for the company operations. The company readiness to provide the facilities to the students showed the company need of the student workforces.

This study also supported a research by Hughes, et al. (2002: 382) that the industry motives to participate in the student learning were to contribute to the education and community, to improve the company image, and to fulfill the shortage of the workforce. The director of PT JSK explained that the motives of his company were especially to contribute to education and community as a company social responsibility and to improve the company image. The leaders of PT Exsa Internasional were mainly motivated to fulfill the need of operator workers when the work volume exceeded the working capacity of the company's employees.

Based on the research results, it was formulated a model of learning for the vocational high schools of the Surveying and Mapping program through school-industry partnerships (Figure 1). The learning model aimed to the students having knowledge, skills, and attitudes required to work as a surveying and mapping operator. The vocational high schools conducting the Surveying and Mapping program established partnerships with the surveying and mapping industries to implement the learning. The partnerships required the

leaders of the schools and the industries to make agreements between the two parties. The learning could be implemented by participation of the students, industry practitioners, and teachers concurrent with their roles.

In the learning model it was described the learning goals, the learning materials, the learning methods, the learning media, the learning activities, and the learning evaluation. It was also described the learning preparation describing the readiness of the students, industry practitioners/industries, and the

implementation costs. The learning model included guest teaching, orientation for industrial practice, industrial practice, students' industry visit, up-to-date technology training, and vocational practice examination. The roles of the industry practitioners were varied according to the implemented learning models, namely as source persons, advisers, guiders, instructors, and external assessors. The roles of the teachers also varied as moderators, advisers, accompanier, and internal assessors. The partnership model can be seen at Figure 1.

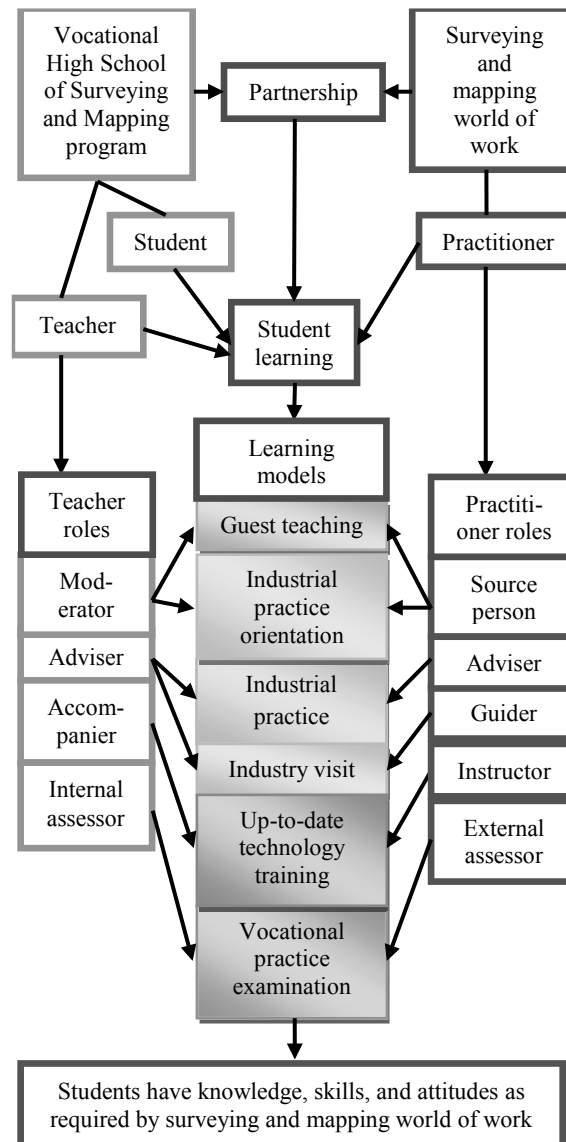


Figure 1. The Partnership Learning Model

The guest teaching by the industry practitioners is needed to equip the students with the view of the details of the surveying and mapping world of work. The practitioners' experiences of the world of work are needed to deepen the competencies of the Surveying and Mapping Budgeting Plan, the Work Health and Safety, and Customer Need Identification.

The industrial practice orientation could be conducted around two weeks before the students start their industrial practices. Beside by their teachers, an orientation by industry practitioners is needed, so the students have the view directly by the actors of the world of work. Various matters need to be fully comprehended by the students when they enter the world of work.

The industrial practices have been conducted by all researched schools, with various time periods around three to four months. The world of work having been the majority as places for industrial practices was BPN. This could be understood, because it is evenly spread in each regency/city. Besides that, the BPN offices are always ready to accept students doing industrial practices because there are always the works along the year, although the work volume is not evenly distributed. This is different with the other institutions, especially the private companies that the surveying and mapping works exist or not is uncertain during the scheduled industrial practices. Therefore scheduling the industrial practices need to consider when the institution to conduct industrial practices have or do not have works.

The world of work being appropriate as an object of industry visits is a national scale institution in the surveying and mapping fields, which could be a government institution or a private company. In order that the visit goals could be achieved, before departing the students need to have a view of the object that will be visited, that can be done by presentation about the institution by the teacher. The students need to be given a task to prepare a question list before the visit and to present a report after that.

The question list and the related answers from the practitioners of the visited world of work could be wrapped up in the students' report. The up-to-date technology training could be conducted just prior to the student graduation, to equip them with the competency to use the up-to-date technology. Nowadays the up-to-date technology needed to be mastered is the measurement using total station. The training must be conducted through school-industry partnerships, because the schools generally do not have or are lack of the up-to-date equipment and there is a lack of experience of the teachers with such technology.

The world of work being the school partners of course those have the equipment and competent human resources in using the up-to-date technology. To make coordination easier, it can be attempted that the industry also should be involved in the other learning models through the school-industry partnerships, such as industrial practice orientation, industrial practice, guest teaching, or vocational practice examination.

To minimize the cost, the involved world of work should not be located too far from the schools. Based on the experiences of the practitioners, one week training is sufficient to prepare the participants to be surveying and mapping operators using total station. The learning evaluation could be by direct monitoring to the progresses of the students' competencies during the training.

It has been determined by the Education National Standard Agency or Badan Standar Nasional Pendidikan (BSNP) that in the vocational practice examination there must be an external assessor from the world of work. The external assessor is involved from the planning, implementation, to the evaluation. To make coordination easier, the external assessor is also chosen who has been involved in the other learning models with the school-industry partnerships such as industrial practice orientation and industrial practice.

The vocational practice examination is conducted on semester 6 for 24 hours or three

days. The implementation of the examination includes three working steps, namely the data collection, the data processing, and drawing. In the data collection step, the students work in groups of three to five persons. Each student changes the roles as surveyor, surveyor assistance, and helper. The implementation of the guest teaching was apparently not as easy as placing students for industrial practices as a study by Velde (2009). However the learning model of guest teaching in this research could be implemented. Even the schools only needed to provide the transportation of the guest teachers from the hotel to the school and vice versa.

Wahyu Nurharjadmo (2008: 220) explored the industrial practice orientation was done by the teachers and the instructors from the partner institutions. The places for industrial practices of the Surveying and Mapping include around eight institutions, while the practitioners of the world of work giving orientation was only from one institution. Therefore it need to be selected a practitioner who relatively mastered the basic competencies of the surveying and mapping being valid for various industries where the industrial practices take place.

Finding out the places for industrial practices was relatively easy, in accordance with a study by Velde (2009) that most of the managers (67%) were ready to accept students to have their industrial practices. The researched vocational high schools generally did not find any difficulty to find the places for industrial practices, especially the government institutions. The private companies were actually also ready to accept the students for industrial practices, the constraints were only the works exist or not at the time. The vocational high schools perceived the dual system as industrial practices as found in a study by Wahyu Nurharjadmo (2008).

This study is in accordance with a research by Hughes, et al. (2002: 382) that most of industries were ready to accept the students' visit. The selected industries were ready to accept the students to visit them. The only constraint is when the visits will be conducted.

The schools were not free to choose, but the industries would determine it, such as in PT JSK and PT Exsa Internasional.

The need of the up-to-date technology training for students is in accordance with a research by Jestrab, et al. (2009). The industry practitioners are needed to train the students and to be guest teachers in the learning of new technologies marked by a shortage of text books, equipments, and experts. The technologies in the researched schools were far behind those in the industries such as in PT JSK and PT Exsa Internasional. The presence of the industry practitioners for three to four days as external assessors on the vocational practice examination could be optimally utilized by the schools. The teachers could communicate to the practitioners, although they do not sit formally as school advisory board members as stated by Hughes, et al. (2002: 378). Besides examining the students, the industry practitioners could provide information of the progresses of the world of work and the needed competencies and advices to improve the learning and to review the curriculum.

## CONCLUSION

The research concluded as follows. The existing learning through partnerships with the surveying and mapping world of work conducted in the vocational high schools were industrial practice, vocational practice examination, guest teaching, and industrial practice orientation. The industrial practices in the private companies benefited more to the students than that in the government institutions, because the students could obtain more comprehensive competencies and financial supports by the companies. The constraints of the implementation of the learning through partnerships with the world of work that could be identified were mainly the locations of the world of work were far from the schools and the schedules of the world of work did not always match the school schedules. In the industrial practices in the private companies, the students could only be involved in the projects that the schedules were relatively loose and the clients had fully trusted

the companies. The alternatives to develop the learning could be by improving the quality of the existing learning having been done and by adding the learning models. The improvement of the learning could be attempted by the vocational high schools having not implemented industrial practices in the private surveying and mapping companies. Adding the learning could be attempted by the vocational high schools having not conducted industry visit, guest teaching, and up-to-date technology training. The implementation of the developed model shows that the model is feasible and effective to prepare the students with the competencies required by the world of work. By such learning the students achieved knowledge, skills, and attitudes needed to be a surveying and mapping operator as required by the world of work. The models of learning through partnerships with the world of work that could be implemented in the Surveying and Mapping program of the vocational high schools include: guest teaching, industrial practice orientation, industrial practice, industry visit, up-to-date technology training, and vocational practice examination.

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