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Assessment of Industrial Internship Instruments for Students of Machine Engineering Education

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Every student who is majoring in Mechanical Engineering Education (MEE) at the Faculty of Engineering, Manado State University has to study both theoretical and practical aspects. In the curriculum, students are required to follow the practice of the course and this entails that they must also engage in practical activities related to the industry. Practical activities need to demonstrate the competencies obtained by students while practicing in the industry. The research objective is to design instruments to measure student practical activities in the industry. In this study the research and development (R&D) method of the Borg & Gall model is used. The findings obtained in this study are: (1) the developed instrument products meet the validity requirements, (2) the instrument developed is very practical and can be effectively used to measure the practical activities of students majoring in MEE in the industry.

Key words: *Assessment, Instruments, Industrial, Practice, Mechanical, Engineering.*

Introduction

The development in a state depends on human resource quality (SDM) proprietary. Qualified human resources depend on the education process. One indicator of qualified human resources is labour. To anticipate that, the factor will press the unemployment rate. Indonesian unemployment is ranked 3rd of 10 states in South-east Asia (Dkatadata, 2010) where the unemployment rate is below average (TKT), up to 5.13% (BPS, 2018). This means SDM labour is still relatively low compared to other states in South-east Asia. Indonesia is currently preparing human resources who can follow technology development to they can compete with the external world, in particular South-East Asia states (Hasanah et al., 2016). A variety strategy is conducted by the college through study programs results from graduate

programs that develop particular competence and directly work with industry of the world as amongst those study programs at PTM Manado State University

This is in collaboration with industry so that college students are able to complete an internship through industrial or field Industrial practice (FIP). This means FIP is not only facilitated by Vocational High School (SMK) but also by many faculties at college, amongst those are faculties of engineering and economics. Based on the pre-survey, the instrument to measure FIP activity was not available and it is hard to determine PTM college student interest to perform FIP activity. In learning, three domains should be measured, which are cognitive concerning mental skill, affective which is about feeling and emotion, and psycho motor skill (Bloom et al., 1956; Anderson and Anderson, 1982; Anderson and Krathwolh, 1981).

Literature Review

FIP constitutes a double system education program (PSG) which is an education institution program where industry is the executor that functions in an entrepreneurship world or industry (Susana, 2015). SPG is a realization of Link and Match's policy (Stevani, 2015). SPG in industry constitutes internship placement for a student (Wena, 1996). According to Sulistyowati, (2014) the aim of SPG is basically the internship industry job part of PSG. This means the aim from industry practical job equals the aim from PSG which is (1) result professional labour who have professional membership, (2) strengthens links and match between school and job worlds, (3) increases education process efficiencies and qualified labour training professionals, and (4) give confessions and appreciations to qualified job experience professional.

FIP is a part of education progress that works directly in the industrial world to attain professional skills (Djojonegoro, 1998) To get a particular professional level, professional's education institutions shall fuse systematic with industrial which program is directed (Anwar, 2004). The aim of FIP is to equip participants with skill and forms in an appropriate attitude learned in context of world industry (Sulistyowati, 2014). FIP activities are carried out by students from small, medium and large scale industries. The process of implementing these practical activities must be planned according to learning relevant to the curriculum (Sanjaya, 2006). Before implementing FIP, schools and industries need to discuss activities that will be carried out through meetings, especially discussing academic schedules (Faizal and Burhanuddin, 2018).

FIP activities for students will gain direct experience. Learning is best through direct experience, in addition to students observing directly they can appreciate and be directly involved in working and responsible for what they do (Arsyad, 2000). The implementation of FIP activities is very helpful for students to strengthen learning outcomes obtained through

educational institutions and create provisions for real experiences that are relevant to their study programs (Susana, 2015).The same statement was made by Kartikawati and Robianto, (2016), the implementation of FIP, namely the theory obtained at school will be applied in the form of practice through real experience in the industry. Experience is an activity that has been effected with real activities through action (Siregar and Tambunan, 2017). Experience gained from the world of work is needed after students graduate because experience blends knowledge and skills gained from practical activities outside of school (Chalpin, 2006).

Some of the benefits of implementing FIP include that work attitudes can develop, competencies will not be obtained only from formal education (schools), students will contribute to the workforce in the industry, students will be motivated and foster a work ethic, this type of endeavour will strengthen industrial cooperation with educational institutions and industry will provide assistance with graduates of educational institutions having the opportunity to gain promotion, and so on (Mawaddah and Maryanti, 2016). The supervisor should conduct orientation in the industry before students implement FIP activities (Susena, 2005). This relates to the evaluation conducted by lecturers. Each tutor should monitor and pay attention to all aspects of student activities at the location (Susana, 2015). For the smooth implementation of FIP, evaluation is imperative (Hamalik, 2007).

Industrial work practice (PRAKERIN) programs that have been carried out by students need to be evaluated to determine the compatibility between the program and its implementation. This is intended as a basis for the preparation of a follow-up program that must be carried out both towards the achievement of student competencies and towards the internship program (Susana, 2015). Evaluation is very important to determine whether an activity is successful or not, including its learning activities. The results of the evaluation will be used as a reference for making policies or decisions. Evaluation is inseparable from measurement and assessment. Before evaluating, the first thing to do is to measure using a measuring instrument. The results of this measurement will be obtained with values in quantitative form. This value is often called data and then analyzed. The results of the analysis serve as a reference for evaluation (Ajayi, 2018; Ponto, 2016). Evaluation is an activity of gathering information about the workings of individuals and this information is used for decision making, according to a systematic process for collecting, analyzing, and interpreting the information to determine the extent to which learning objectives have been achieved by students.

Measurement is defined as an activity carried out to provide numbers for a symptom, event, or object so that the measurement results will always be in the form of numbers. In the learning process teachers also take measurements of the process and the results in the form of figures that reflect the achievements and processes or learning outcomes. According to Arifin, (2013) measurement is a process or activity to determine the quantity of something. In the measurement process, of course, the teacher must use a measuring instrument.

Quantitative measurements include measuring the progress of student learning (Sudijono, 2011).

Evaluation is defined as the process of determining the value of an object. To obtain a value, it is necessary to have a measure or criteria Assessment is the process of gathering and processing information to determine the achievement of student learning outcomes (Saputra et al., 2014). Based on the above study, the evaluation, measurement, and assessment are related to one another. In this case, an evaluation must be carried out first, namely measuring and from the measurement results obtained values. The values obtained are then analyzed, the results of the analysis are used as evaluation material. To accomplish this it is necessary to have a measuring instrument. In this research, a measurement tool will be designed to measure industrial work practices by PTM students.

Methodology/Materials

This study used a research and development (R&D) method of the ADDIE (Analysis-Design-Develop-Implement-Evaluation) model developed by Dick and Carry (1996):

- Analysis, including conducting a pre-survey in the industry to identify problems and determine what aspects will be measured followed by a literature study related to measuring instruments;
- Design, this stage is to determine what indicators are by the product to be developed. In this activity design indicators based on problems and literature studies;
- Develop, which is a stage for product development. Items refer to indicators, then determine the scale of assessment. This scale is very important with the aim of making measurements then quantitative data will be obtained. The scale used for validation is used the Liker scale, which is very good (4), good (3), enough (2) and not good (1). The results of this development will be obtained by measuring instrument product models. This product cannot be used because it is not yet known whether this measuring device meets scientific standards. According to (Arifin, 2013), the measuring instrument must be standard, which has a high degree of validity (Arifin, 2013). To find out the level of validity of the measuring instrument, at the early stages, validity will be carried out by 3 people, namely 1 validator in the field of measurement and evaluation, from PTM lecturers and 1 from the industry. The formula to calculate the validation coefficient uses equation 1.

$C\_v = \Sigma V / N$ (Dkatadata, 2010)

Where: C_v = coefficient of validity, ΣV = total validator value, and N = total evaluators.

To determine the level of product validity, see Table 1 results below.

Table 1: Validity Rate

Range	**Note**
$C_V > 3.4$	Very valid
$3.0 < C_V \leq 3,4$	Valid
$2.6 < C_V \leq 2.9$	Less valid
$C_V \leq 25$	Not valid

4) Implementation, after the product meets the validity requirements, this stage conducts a trial in order to obtain the practicality and effectiveness of the product used to measure student activities in industrial work practices. To measure the severity and effectiveness, a Likert scale is used which is very practical-effective (4), practical-effective (3), less practical-effective (2) and not practical-effective (1). Product practicality coefficient, used equation 2.

C_P= ΣP/N (BPS, 2018)

Where: C_P = practicality coefficient, ΣP = total value given by the assessor, and N = total evaluators.

To determine the practicality of the product, see results as presented in Table 2 below.

Table 2: Practicality levels of products

Range	**Note**
$C_P > 3.4$	Very Practical
$3.0 < C_P \leq 3,4$	Practical
$2.6 < C_P \leq 2.9$	Less practical
$C_P \leq 25$	Not Practical

Whereas to find out the product effectiveness coefficient equation 3 is used.

$$C_E = {\Sigma E}/{N} \qquad \text{(Hasanah et al., 2016)}$$

Where: C_E = effectiveness coefficient, ΣE = total value given by the evaluator, and N = total evaluators.

The effectiveness level of the product is presented in Table 3 below.

Table 3: Product effectiveness levels

Range	**Note**
$C_E > 3.4$	Very Practical
$3.0 < C_E \leq 3,4$	Practical
$2.6 < C_E \leq 2.9$	Less Practical
$C_E \leq 25$	Not

4) Evaluation, after testing the product the final stage evaluates the product by making product improvements.

Based on the results shows that the design of the assessment instruments meets the requirements of validity, practicality, and effectiveness. The importance of this assessment instrument can be used for data collection to evaluate the competency of student practice skills [Ponto, Tasiam & Wonggo, 2018).

Results and Findings

The validation data are presented in Table 4 below.

Table 4: Data validation.

Validator	Score
1	4
2	4
3	4
Total score	12

Data in Table 4 were analyzed using formula 1. The results of the analysis were obtained C_v = 4. Table 1 shows that C_V = 4> 3.4 and this means that the developed product is classified as very valid. This product can be continued at the next level, namely practicality and effectiveness trials. For the trial, 6 assessors were involved, namely 3 industry people and others came from PTM lecturers at Manado State University.

Practicality trial data is shown in Table 5 below.

Table 5: Validation data

Validator	Score
1	4
2	4
3	3
4	4
5	4
6	4
Total score	23

After the data in Table 5 are analyzed using formula 2, the results of the analysis are obtained C_P = 4. From Table 3 the score C_P = 3.8> 3.5 and this means that the developed products are classified as very practical. This instrument is very practical to be used as a measuring tool in measuring student activities at FIP.

The following will be analyzed the effectiveness of the product. The data used for analysis are presented in Table 6 below.

Table 6: Validation data

Validator	Score
1	4
2	3
3	4
4	4
5	4
6	3
Total score	22

By using formula 3, the score C_E = 3.7. This score is at C_P = 3.7> 3.5. the results of data analysis show that this instrument is effective for measuring student practice activities at FIP.

Based on the results, the design of the assessment instruments meet the requirements of validity, practicality and effectiveness. The importance of this assessment instrument is its potential use for data collections to evaluate the competency of students practice skills (Ponto et al., 2018)

Conclusion

Based on the results of the study, it can be concluded as follows:

1. This instrument meets the validity requirements, which means it is accurate to be used to measure practical activities;
2. The product of the development is very practical to measure student activities in FIP; and
3. The instrument product developed is very effective for measuring student activities at FIP

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