Plumbing work competence instrument in the field of civil engineering

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Abstract. Plumbers determine the quality of water installations, networks, and management so that the position of plumbers becomes important in maintaining the health of the environment and buildings. This research was conducted with the aim of measuring the validity of plumber's competency instruments. The research method used is descriptive by involving several expert judgments. The results obtained show that the competency plumbers instrument needs to be thoroughly improved both the content, constructs, and criteria, which are adjusted to the development of the labor market and current industry needs.

1. Introduction
To carry out building installation and maintenance work in Indonesia, the competence of good construction workers is needed [1]. The number of skilled workers in the construction sector who are classified as competent in Indonesia is still below 10% of the total of 8 million workers [2]. On the other hand, the need for skilled labor in the construction field is very urgent to be fulfilled in the pipeline sector, Indonesia needs a lot of certified plumbers to overcome the lack of clean water availability [3]. Regarding certified labor, there are only 496,654 certified workers from 237 sub-fields of expertise. In the new plumber’s competency 777 people have been certified [4]. The data can be seen in the table below:

| No | Code   | Name of sub-field  | Lv-III | Lv-II | Lv-I | Total |
|----|--------|-------------------|--------|-------|------|-------|
| 1  | TT001  | Executor          | 180    | 782   | 1.245| 2.207 |
| 2  | TT002  | Supervisor        | 3      | 8     | 33   | 44    |
| 3  | TT004  | Sanitary          | 1      | 14    | 46   | 61    |
| 4  | TT005  | Plumber           | 98     | 202   | 447  | 747   |
| 5  | TT016  | Foreman Plumber   | 25     | 2     | 3    | 30    |
| 6  | TT017  | Foreman           | 0      | 0     | 15   | 15    |
|    | Total  |                   | 307    | 1.008 | 1.789| 3.104 |

Work, Installation, and material Poor plumbing in buildings is one of the factors that contaminate water and cause various diseases [5]. Special attention is required to the plumbing network, especially in the material, the formation and release of biofilms, accumulation, and resuscitation and lose deposits [6]. In addition, the pipeline system also contributes to the comfort of a building [7]. Thus, the installation of plumbing plays an important role in human health in one environment.
Maintaining the quality of water to avoid harmful substances and microbes related to tissue, temperature and time [8] is the main task of plumbers. Therefore, knowledge of plumbing materials is needed. There are plumbing materials such as glass, galvanized steel, stainless steel, copper, Polyvinyl chloride (PVC), Polyethylene (PEX-c) and Cross-linked Random Polymer (PPR) that affect water quality [9].

Assessment and measurement of competency are needed by measuring instruments with valid, objective, and consistent quality [10]. Competency measurement tools from plumbers should be of good quality so that certified workers can be accountable for their abilities [11]. The number of a plumber that is very little compared to the needs of the community is a strong indicator in assessing how well the assessment process and instruments are used to measure the competency of plumbers in Indonesia.

The quality of instruments that can measure and predict the competence of plumbers in Indonesia needs to be studied further. Because in addition to construction, plumbers have an important role to play in determining environmental health and building renovations. Instruments that measure competency should include elements: Knowledge [12], Skills [13], Attitudes and relevant work in the field [14–16].

2. Methods

This research method is based on a descriptive design. Using 6 expert judgment with the national qualification framework as a guide. Data collection was carried out with assessment questionnaires and expert judgment in the field of instruments (3 experts) and plumbing (3 experts) using the Differential Semantic scale. After conducting data collection, a validation test using the V-Aiken formula was conducted on the plumber's competency instrument. The analysis in this study was broken down into 2 components, namely: the content validity and construction of the instrument.

3. Result

The results of the study are divided into 2 (two) major sections, namely: content validation and construction of plumber's competency instruments. In both parts, there are 3 (three) sections on the instrument, namely: knowledge test, practice test and checklist theory and practice (observation). The V-Aiken range obtained was between 0 and 1.00 with categorization < 0.6 (low / poor), 0.6 - 0.8 (moderate / good) and > 0.8 (high / very good) [17].

3.1. Content validation

Based on the expert judgment which was then analyzed by the V-Aiken formula the results of the content validity were obtained as follows:

| No | Performance test | Knowledge test | Observation |
|----|------------------|----------------|-------------|
|    | Item             | Coefficient of validity | Item | Coefficient of validity | Item | Coefficient of validity |
| 1  | Accuracy in the use of work safety equipment, clothing, shoes, etc. | 0,667 | Definition of wastewater | 0,667 | Following the K3 Directive | 0,917 |
| 2  | The accuracy of the work tools used | 0,583 | Definition of wastewater | 0,75 | Select and use equipment | 0,417 |
| 3  | Accuracy in the use of fitting fittings | 0,583 | Selection of pipe diameter | 0,417 | Identifying plumbing components | 0,333 |
| 4  | How to connect pipes | 0,583 | Definition of Traps | 0,417 | Assemble Plumbing | 0,5 |
| 5  | The neatness of the tools used during the pipework process. | 0,75 | Trap Section | 0,667 | Compare results | 0,583 |
Table 2. Cont.

| No | Item                                                                 | Coefficient of validity | Item                                                                 | Coefficient of validity | Item                                                                 | Coefficient of validity |
|----|----------------------------------------------------------------------|-------------------------|----------------------------------------------------------------------|-------------------------|----------------------------------------------------------------------|-------------------------|
| 6  | The tidiness of pipe working equipment storage                       | 0.583                   | Purpose of Installation Ven                                        | 0.667                   | analyze and group information according to procedures and criteria | 0.667                   |
|    | Definition and cause of missing Water Bulkhead                        | 0.417                   | Provide the right ideas and information according to standards     |                         |                                                                      |                         |
| 7  | Definition of Pipe Ven Up                                             | 0.75                    | Plan and arrange activities and inspect the instructor              |                         |                                                                      |                         |
| 8  | Definition of Wet Ven Pipes                                           | 0.667                   | Use of resources needed in achieving goals                         |                         |                                                                      |                         |
| 9  | Ven pipe requirements                                                  | 0.583                   |                                                                      |                         |                                                                      |                         |

Source: Score’s analysis

The results of content validity generally show a low score. Items classified as good only contain work safety, the definition of knowledge and classifying work. If reviewed further, the contents of the instrument still do not meet the accuracy in the actual plumbing work. Therefore, it is necessary to improve the contents of the instruments.

3.2. Instrument construction validation

Based on the expert judgment which was then analyzed by the V-Aiken formula the results of the instrument construction validity were as follows.

Table 3. Instrument construction validation of competence plumbers instrument.

| No | Performance test | Knowledge test | Observation | Coefficient of validity |
|----|-------------------|-----------------|-------------|-------------------------|
|    | Item              | Coefficient of validity | Item         | Coefficient of validity | Item                                | Coefficient of validity |
| 1  | Accuracy in the use of work safety equipment, clothing, shoes, etc. | 0.556            | Definition of wastewater | 0.222                | Following the K3 Directive | 0.389                   |
| 2  | The accuracy of the work tools used                                 | 0.444            | Definition of wastewater | 0.222                | Select and use equipment          | 0.056                   |
| 3  | Accuracy in the use of fitting fittings                             | 0.111            | Selection of pipe diameter | 0.111               | Identifying plumbing components   | 0.111                   |
| 4  | How to connect pipes                                               | 0.5              | Definition of Traps | 0.389                | Assemble Plumbing                | 0.389                   |
| 5  | The neatness of the tools used during the pipework process          | 0.444            | Trap Section           | 0.444                | Compare results                  | 0.389                   |
| 6  | The tidiness of pipe working equipment storage                      | 0.5              | Purpose of Installation Ven | 0.444               | analyze and group information according to procedures and criteria | 0.222                   |
|    | Definition and cause of missing Water Bulkhead                       | 0.333            | Provide the right ideas and information according to standards     |                         |                                                                      |                         |
| 7  | Definition of Pipe Ven Up                                           | 0.167            | Plan and arrange activities and inspect the instructor              |                         |                                                                      |                         |
| 8  | Definition of Wet Ven Pipes                                         | 0.222            | Use of resources needed in achieving goals                         |                         |                                                                      |                         |
| 9  | Ven pipe requirements                                                | 0.444            |                                                                      |                         |                                                                      |                         |

Source: Score’s analysis
The results of the overall item construction validity showed a low score. None of the items belong to the good construction category. Both from the aspect of clarity of instrument instructions, clarity of indicators and clarity of items in measuring indicators. If reviewed further, the contents of the instrument still do not meet the accuracy in the actual plumbing work. Therefore, it is necessary to improve the contents of the instruments.

4. Discussion
Indicators of achievement of plumbers are divided into several elements of competence. low results because the instrument does not have items that measure all competency indicators that are the hope of achieving plumbers. This condition is similar to that stated by Dardiri that the low competence of workers in Indonesia in the construction sector is due to the lack of relevance between work and the abilities taught [18]. That is, the skills shown are not related to the learning and training they obtain [19]. On the other hand, the contents of the instrument are generally closely related to the training material. While experts who assess instruments are practitioners in the plumbing field. So it is worth saying that the contents of the plumbing instrument are stated to be less relevant to the work in the field.

The ability of plumbers to implement their competencies in the form of sanitation work is the most important thing. Ability to prepare materials and tools, cut and connect, group and select pipes and implement piping systems for both clean water, waste and dirty water [19]. Besides that, the plumber also needs the ability to understand good terms [20]. These competencies do not appear clearly in this instrument. Construction of instruments does not have a rating scale that can represent the stages carried out during the assessment period, the instrument refers to the result right or wrong so that there is no alternative assessment or level of achievement of the competency of plumbing workers. In addition, the ability to cooperate is also considered important in realizing harmony in the work team [21]. The overall shortcomings should be a consideration and improvement step for this plumber's competency instrument.

In the implementation in the field, it is necessary to understand that the whole instrument should be made as well as possible and comprehensive to accommodate the competency needs that should be owned by workers. Therefore each instrument that measures knowledge, attitudes, and skills should be separated according to needs and made as effective as possible so that it does not require a long time in its application [22].

Measures for increasing the impacts of the vocational training programmed are identified in terms of better targeting and profiling the trainees and closer adjustment of the programmed to the specific needs of the labor market [23]. Theoretical approaches work by synthesizing related literature, while practical approaches utilize simulated design tasks or real-life design projects [24].

Based on the description above, it will be more relevant if the instrument focuses more on the framework of national qualifications relevant to the needs of the labor market. Developed together with education and industry practitioners to fit the type, construction, and contents. Covers the realm of knowledge, attitudes, skills, and teamwork. Instruments are prepared based on real needs and in accordance with the characteristics of the performance to be measured.

5. Conclusion
An instrument that is assessed with low validity, should be improved. Instrument competence should not only see the final results but also be able to provide an assessment of the criteria, content and each process carried out [25]. Plumber’s Instrument competence currently cannot be said to represent the national qualification framework. The strong relevance of education and training to industry needs is the most important thing at this time [26]. Connectivity can be clearly seen in the framework of qualifications and instruments of competence [27]. Therefore, the best instruments are needed to measure the skills of plumbers with high relevance to the industry.
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