

## Development and Validation of a Competency-Based Learning Package in Plumbing NC II

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### ABSTRACT

*The study aimed to develop a competency-based learning package in Plumbing NC II. Specifically, it determined the validity of the learning package in terms of objectives, activities, instructional characteristics, evaluative characteristics, and physical make-up. The descriptive-development methodology was used in the study. In addition, content validation was conducted by three experts in Outcome-Based Education. Results showed that the material generally meets the standards of a Competency-Based Learning Material. It has a very high level of validity particularly along with its objectives, activities, instructional characteristics, evaluative characteristics and physical make-up. The developed competency-based learning package is strongly recommended for use in training students for the Plumbing NC II assessment. The use of the learning package may reduce the workload of the trainers while students are engaged to self-directed learning and to ensure to cover all the competencies that shall be developed by the students.*

**Keywords:** *Competency-Based Training, Construction, Workbook*

### INTRODUCTION

Plumbing as an integral part of the civil construction industry is the art and technique of installing pipes, fixtures, and other apparatuses in buildings for bringing in the supply, liquids, substances and/or ingredients and removing water, liquid, and other carried-wastes hazardous to health, sanitation, life, and property (TESDA, 2014).

Learning plumbing as a trade can be attained under the Competency-Based Training (CBT) delivery approach which is generally required by the Technical Education and Skills Development Authority (TESDA) for learners in the field of technical education and skills development. CBT is focused on the development of the competencies of learners as an outcome of the training. It emphasizes the actual capability of the learners. Skills, knowledge, and attitudes are the concerns that need to be attained as required in the specific competency level (Glossary for Education Reform, 2014). In the delivery of instruction, expected outcomes, identified by the teachers or instructors, will be their basis of designing learning activities. Instructional materials are prepared and utilized. Learners are engaged in relevant activities in order to gain the expected competency, and as a result, they can deliver the necessary performance required in the workplace. The necessary competencies that a plumbing trainee has to develop are reflected in the Plumbing National Certificate II (NC II) Training Regulations (TR).

Books and other instructional materials are very important in the knowledge construction process for learners because they help them gain a better understanding and deeper knowledge in the subject areas that they are studying. According to Rogayan and Dollete (2019), with the issues on the scarcity of learning materials, teachers are challenged to develop appropriate instructional materials that may enhance student learning and may resolve such lack. They also stated that there have been several studies in the development of instructional materials such as the development of micro lab kits (Evangelista et al., 2014; Ocampo et al., 2015; Pastor et al., 2015), development of modules in physics (Auditor and Naval, 2014; Gagarin, 2003), development of science laboratory manual (Bayle, 2004), validation of workbook in science (Rubo, 2005), and module development for science investigatory project (Libranda, 2004). However, there have been few studies focusing on the creation and assessment of competency-based learning materials in Plumbing NC II.

Trainers in plumbing are advised to develop their Competency-Based Learning Materials (CBLMs). However, it is quite not easy to fully develop one because it entails a lot of time, effort, dedication, and above all, expertise in the field in order to have a functional one. A well-developed CBLM would package all the necessary competencies, activities, and other aspects of the comprehensive development of trainees in Plumbing NC II.

With the abovementioned premises, crucial is a fully developed Competency-Based Learning Material in Plumbing National Certificate (NC) II which is duly validated by experts and trainers in Plumbing and partners in civil-work industries related to test its fitness for use.

The developed instructional material would be a great help for the following: 1) the administrators of TESDA-accredited training providers in Plumbing NC II, 2) the trainers as well as the trainees in Plumbing NC II as they would have ready materials in building competencies, 3) Plumbing enthusiasts as new ideas may be derived from the CBLM, 4) instructors and professors in colleges and universities who are teaching Plumbing classes under the civil building technology areas, and 5) researchers and module writers as some ideas may be provided in coming up with their studies or projects.

### **Purpose of the Study**

The study's goal was to create and validate a competency-based learning package in Plumbing NC II. The study's specific goals were to: 1) develop a competency-based learning package in Plumbing NC II that is aligned with the Training Regulations; and 2) determine the learning package's level of validity in terms of objectives, activities, instructional characteristics, evaluative characteristics, and physical make-up.

## **METHODOLOGY**

This study used Descriptive-Development Methodology. Some of the methods used by (Pacpaco, 2018; Paguirigan, 2020; Perilla & Malicdem, 2019) were also considered in this study. The descriptive method of research (Fonorella, 1993) aimed at determining the normal, typical, and current condition existing in a particular place of the study. It is used to obtain information about the current status of a phenomenon in order to describe "what

exists" in terms of variables or conditions in a situation. The development method is also used to prepare and develop educational outputs so that they can be used over a vast area.

This research was divided into three stages: planning, development, and evaluation. In the planning stage, the researchers gathered information on the list of references that the trainers have been using for the realization of the intended learning outcomes for their trainees. These references were analyzed in terms of the applicable competencies where the contents or topics fall based on the training regulations in Plumbing NC II.

The development stage involved the writing of the Competency-Based Learning package in plumbing. The learning package was composed of twelve learning modules otherwise known as Competency-Based Learning Materials (CBLMs), each respectively providing the necessary knowledge, skills, and attitudes for the twelve units of competency which were prescribed in the Training Regulations of Plumbing NC II. Though the training package was patterned to the Competency-Based Learning Materials (CBLMs) of TESDA, the researcher included the use of Quick Response (QR) Code which is a machine-readable code and is made up of black and white squares that store uniform resource locators (URL) of internet sources, text or phone numbers, among others. The QR Codes are used to simplify the link to an internet source instead of copying and pasting their lengthy URLs. The researcher used the Training Regulations for Plumbing NC II as a reference in identifying the necessary competencies to be developed. Extensive reading from different print and non-print sources was done by the researcher to gather enough knowledge so that the necessary information to address a specific competency be met. In the CBLM, Information Sheets were used to provide specific information that trainees need to learn under a certain competency. After which, a Self-Check is provided to test how much the trainee learned by referring to the Answer Key to Self-Check for the correct answer. The QR Codes provide a link to a specific URL on the internet which may be necessary to augment the text in the information sheet, or it may be linked to a YouTube channel for a video demonstration of how a certain job may be done. Performance Tasks were provided to check how much skills a trainee had developed by giving demonstrations on how to carry out a specific job. The Performance Checklist was used to measure the trainees' skills on that matter. The CBLMs were printed in medium-sized substance 20 bond papers, bound with plastic binding rings, and had transparent Poly Vinyl Chloride (PVC) sheets for the front and back covers.

The level of validity of the competency-based learning package in terms of its objectives, activities, instructional characteristics, evaluative characteristics, and physical make-up was determined by the following: three trainer-assessors in Plumbing NC II, one university instructor teaching industrial arts along construction industry wherein plumbing is among the subjects, one practicing architect who is involved in civil construction, one department head in building and water services maintenance of a state university, and one expert/consultant in knowledge-based book writing and head in outcomes-based instructional (OBE) materials development committee in a state university.

A validation instrument was used to check the content validity of the competency-based learning package which was adapted by the researchers from Vizcarra et al. (2017). A parameter on the physical make-up of the learning package was included to enrich its characteristics. The learning package was further validated by expert trainers in Plumbing

NC II, experts in OBE module writing, and experts in the construction which included a civil engineer and an architect.

Weighted mean was used as the statistical tool for the content validation of the developed competency-based learning package in Plumbing NC II. The statistical limits were used to quantify the data in answering the specific problems of the study. For the content validity of the competency-based learning material, a five- point Likert scale was used.

Scale	Range Interval	Descriptive Interpretation
5	4.51-5.00	Very Highly Valid
4	3.51-4.50	Highly Valid
3	2.51- 3.50	Moderately Valid
2	1.51- 2.50	Slightly Valid
1	1.00- 1.50	Not Valid

## RESULTS AND DISCUSSION

### The Level of Validity of the Competency-Based Learning Package in Plumbing NC II

Table 1 displays the experts' assessments of the learning package's objectives. The learning outcomes of the learning package had an overall mean of 4.95, which is classified as Very Highly Valid. This means that all learning outcomes for the various units of competencies were written in accordance with the objectives of a competency-based approach. The results are concise, explicit, and measurable. Furthermore, these use only one action verb that is aligned with the activities and assessments and is written in terms of what the learner will do rather than what the instructor will do. As a result, the material's learning outcomes are Highly Valid.

**Table 1**

*Mean Rating of the Experts' Content Validation on the Objectives (Learning Outcomes) of the Competency-Based Learning Package.*

Criteria	Mean	Descriptive Interpretation
The learning outcomes		
1. are brief and concise.	4.86	Very Highly Valid
2. specify appropriate conditions for performance.	4.86	Very Highly Valid
3. are aligned with the instructional activities and assessment.	5.00	Very Highly Valid
4. are written in terms of observable and measurable behavioral outcomes.	4.86	Very Highly Valid
5. use only one action verb and target one specific aspect of expected performance.	5.00	Very Highly Valid
6. are doable and consider prior knowledge, available time and learning opportunities.	5.00	Very Highly Valid

Criteria	Mean	Descriptive Interpretation
7. are written in terms of what the trainee will do, not what the trainer will do.	5.00	Very Highly Valid
8. are clear and written in language that is understandable to the trainees.	5.00	Very Highly Valid
9. understandable to the trainees		
Overall Mean	4.95	Very Highly Valid

The results are very similar to the Vizcarra's (2017) "Supplementary Outcome-based Resource Material in Reading Comprehension" with a mean rating of 4.59 described as Very Highly Valid.

Additionally, these results are supported by Bunch's (2012) guideline in developing instructional materials which states that choosing standards in developing instruction is very important because this will guide the teacher and the learner in what to achieve and how to achieve them. The validated objectives are reinforced by Fry et al. (2000) in their advice in writing outcomes which include the use of only one verb per learning outcome. Also, learning outcomes must be observable and measurable and are capable of being assessed.

The activities of the developed learning package were also evaluated. Because the activities provided instructional opportunities for achieving the desired results, they were included.

**Table 2**

*Mean Rating of the Experts' Content Validation on the Instructional Characteristics of the Competency-Based Learning Package*

Criteria	Mean	Descriptive Interpretation
The activities		
1. are authentic.	4.86	Very Highly Valid
2. are interesting.	4.86	Very Highly Valid
3. come in different difficulty level.	4.86	Very Highly Valid
4. promote trainees' independence in learning.	4.86	Very Highly Valid
5. facilitate metacognition and knowledge construction.	4.86	Very Highly Valid
6. each learning activity can be mapped to one or more intended learning outcomes (ILOs) and vice versa.	4.86	Very Highly Valid
7. (the different activities) are designed to address all ILOs.	4.86	Very Highly Valid
Overall Mean	4.86	Very Highly Valid

Table 2 shows that the activities in the learning package passed all the outcome-based criteria with an overall mean score of 4.86, described as Very Highly Valid. This further suggests that the activities are authentic and interesting. This suggests that the activities are genuine and interesting. This conforms to Nunan's (1998) claim that materials should be

authentic in terms of text and tasks. Furthermore, it can be observed that the activities come in different difficulty levels which is similar to the claim of Nunan (1998) that in designing materials, the teacher should develop a set of varied activities at different levels of task difficulty. The activities also encourage students' independence in learning, in accordance with Bunch's (2012) recommendation that students participate in communities of practice that foster opportunities for "apprenticeship" that eventually lead to students' full and independent participation. The materials also include activities that promote metacognition and knowledge construction, can be mapped to one or more ILOs, or vice versa, and are intended to address all ILOs. This result is in conformity to Biggs's (1999) and Biggs and Tang (2006) claim that the activities should develop metacognitive skills by being explicit about learning and maximizing students' awareness of their own knowledge construction through structured reflection and are appropriately aligned to outcomes to ensure positive learning.

**Table 3**

*Mean Rating of the Experts' Content Validation on the Evaluative Characteristics of the Competency-Based Learning Package*

Criteria	Mean	Descriptive Interpretation
Assessment Tasks		
1. are valid.	5.00	Very Highly Valid
2. and doable and manageable.	4.86	Very Highly Valid
3. are reliable indicator of the trainees' progress.	5.00	Very Highly Valid
4. are aligned with the intended learning outcome.	4.86	Very Highly Valid
5. require communication of knowledge and /or skills through written form, and oral interview, and demonstration.	5.00	Very Highly Valid
Overall Mean	4.94	Very Highly Valid

The assessment tasks presented in the learning package passed the outcome-based criteria for its evaluative characteristics, as shown in Table 3. The evaluative characteristics of the learning package had an overall mean of 4.94, which is classified as Very Highly Valid. The validators all agree that the assessment tasks are legitimate, doable, and manageable. They are also reliable indicators of learners' progress, are in accordance with the ILO, and necessitate communication of knowledge and/or skills via written form, oral interview, or demonstration.

**Table 4**

*Mean Rating of the Experts' Content Validation on the Instructional Characteristics of the Competency-Based Learning Package*

Criteria	Mean	Descriptive Interpretation
The instructional characteristics		
1. promote participation	4.86	Very Highly Valid

Criteria	Mean	Descriptive Interpretation
2. present topics in logical sequence	4.86	Very Highly Valid
3. use appropriate and various reading texts.	4.86	Very Highly Valid
4. are clear and easy to follow and understand.	4.71	Very Highly Valid
5. arouse the interest of the learners and sustains attention.	4.71	Very Highly Valid
Overall Mean	4.80	Very Highly Valid

Table 4 summarizes the validators' assessments of the instructional characteristics of the resource material. The overall mean of the instructional characteristics is 4.80, which is classified as Very Highly Valid, as shown in the table. This means that the learning package encourages participation, presents topics in logical sequence that is clear and easy to follow and understand, and arouses and maintains learners' interest and attention

**Table 5**

*Mean Rating of the Experts' Validation on the Physical Make-Up of the Competency-Based Learning Package*

Criteria	Mean	Descriptive Interpretation
The physical make-up		
1. include clear and presentable illustrations and graphics.	4.71	Very Highly Valid
2. include legible and typographical-free text.	4.57	Very Highly Valid
3. include general appearance-enhancing color combinations.	4.85	Very Highly Valid
4. adhere to the standard materials (i.e., papers) for book printing.	4.85	Very Highly Valid
5. adhere to standard size for individual learning.	5.00	Very Highly Valid
Overall Mean	4.80	Very Highly Valid

Table 5 presents the experts' validation of the physical make-up of the learning package. It can be gleaned that the physical make-up of the learning package acquired an overall mean of 4.80 described as Very Highly Valid. The validators agree that the learning package includes clear and presentable illustrations and graphics, typographical-free text, and general-appearance color enhancing combinations. The learning package also adheres to standard materials for book printing and standard size for individual learning.

**Table 6**

*Summary of the Experts' Evaluation on the Competency -Based Learning Package*

<b>Criteria</b>	<b>Mean</b>	<b>Descriptive Interpretation</b>
1. Objectives	4.95	Very Highly Valid
2. Activities	4.84	Very Highly Valid
3. Instructional	4.80	Very Highly Valid
4. Characteristics	4.80	Very Highly Valid
5. Evaluative Characteristics	4.94	Very Highly Valid
6. Physical Make-up	4.80	Very Highly Valid
Overall Mean	4.86	Very Highly Valid

Table 6 presents the overall evaluation of the competency-based learning package. It can be gleaned from the table that the component means of 4.95, 4.84, 4.80, 4.94, and 4.80 for the objectives, activities, instructional characteristics, evaluative characteristics and physical make-up respectively all acquired a descriptive rating of Very Highly Valid. With the overall mean score of 4.86, it implies that the learning package meets the standard of a competency-based learning material.

## **CONCLUSIONS**

The competencies required in the Training Regulation for Plumbing NC II are necessary for the holistic development of candidates for the Plumbing NC II course. Hence, a learning package in Plumbing NC II was developed based on the principles of competency-based training. It is valid in terms of objectives, activities, instructional characteristics, evaluative characteristics, and physical make-up. The material is valid to augment the learning references that trainers and instructors in plumbing are using covering the Basic, Common, and Core competencies required in the Plumbing NC II.

## **RECOMMENDATIONS**

The developed competency-based learning package is strongly recommended for use in giving trainings in Plumbing NC II to adhere to the principles of competency-based training, reducing the workload of the trainers while students are engaged to self-directed learning, and ensuring to cover all the competencies that shall be developed by the students. Continuous validation of the learning material shall be done as it is being used in trainings for improvement. Further studies with wider scope should be conducted to validate the results of this study.



### ETHICAL STATEMENT

This study was reviewed and approved by the University of Northern Philippines Ethics Review Committee. Ethical principles observed in the study include the conflict of interest, principle of informed consent, principle of privacy and confidentiality, principle of vulnerability, recruitment, benefits, compensation, and community considerations.

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