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Validation of Instrument on Teaching Practices Among Lecturers at Community Colleges, Yemen

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Abstract

This study aims to explore a set of items measuring the lecturers' teaching practice for developing a true scale of teaching practice. Rasch Model is applied to produce specific measurements on the lecturers' teaching practice in order to generalize results and inferential studies. The items proved to measure a single dimension of lecturers' teaching practice. The developed instrument termed LTP covers five dimensions. Construct validity was achieved through the Rasch Model Analysis using the dimensionality, item fit, and item polarity parameters. The reliability of the instrument was achieved by conducting person and item separation analysis, Cronbach alpha, and calculated person and item reliability estimates. The results of Rasch Model Analysis show that the items of LTP fit the model appropriately.
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Keywords: Implementation; technical education; vocational education; conceptual model; conceptual framework

1.0 INTRODUCTION

Many studies have described aspects of teaching practice, which are related to effective classroom learning and student outcomes [1 ,2 Aguirre et.al, 2010 Watson 2012). Close monitoring, adequate pacing, and classroom management, as well as the clarity of presentation, the lessons well structured and informative and encouraging feedback are - known as essential aspects of "direct instruction". However, this is not enough, while the lecturer provides learning opportunities, they should be to be effective recognized and used by the students. Motivation, goals, and results have to be considered, are taken into account. Therefore, greater in the quality of the instruction is described above as the direct instructions. Klieme et al (2006) described three basic dimensions of the quality of teaching: classroom management clear and well structured (which are the main components of direct instruction), student orientation (including a supportive and individualized instruction), and cognitive activation (including the use of deep content, the higher-order thinking tasks and other demanding activities). These dimensions are "latent" understood as factors related but not identical to the specific teaching methods. These dimensions are fundamental dimension of teaching practices and they can be used for structure identification, and improving student orientation (Lipowsky et al., 2008). Instructional practices depend on what lecturers bring to the classroom. Professional competence is believed to be a crucial factor in classroom and school practices (Shulman, 1987, Campbell et al., 2004; Baumert and Kunter, 2006). These researchers have made studies to measure the effects of constructivist compared with "reception/direct transmission" beliefs on teaching and learning. Peterson et al., (1989) in his research used a domain-general version of two teaching and learning-related indices (constructivist and direct transmission) to cover lecturers' beliefs and basic understanding of the nature of teaching and learning.

Lecturers do not act only in the classroom where they instruct students more or less in isolation from other classes and lectures. A modern view of teaching also includes professional activities on the college level, such as co-operating in teams, building professional learning communities, participating in college development, and evaluating and changing working conditions (Darling-Hammond et al, 2005). These activities shape the learning environment on the college level, i.e. the college climate, ethos and culture, and thus directly and indirectly (via classroom-level processes) affect student learning (Wheatley, 2005). Therefore, teaching techniques are difficult to apply effectively: lecturers are required have a great knowledge of the subject (including knowledge of how to teach the subject to students at the degree level) and the ability to respond quickly to changing only partially predictable in discourse, and require students to take a more active and take more personal risks in their learning (Helmke, 1995; Windschitl, 1999). Moreover, the strong dependence of social constructivist discourse models increases the possibility that the discourse away from the planned objectives and content o f the lesson, and that even when it remains goal-relevant, progress towards the construction of the agreements provided can be erratic and include frequent verbalization misconceptions.

To develop a research instrument requires knowledge about item or question construction, scale development, format, and length, validit and reliability of the instrument and its scores (Sekran, 2003; Creswell, 2012; Johnson and Christensen, 2012). Measuring the

lecturers' teaching practice needs a measurable instrument to be developed and tested. Thus, this study aims to use the Rasch Model (RM) analysis as a powerful tool for evaluating constructs validity and reliability of the instrument in order to use it for interpretation the lecturers' teaching practice. Furthermore, the research questions in this paper are Do the items of lecturers' teaching practice scale have adequate fit statistics, showing that each item relates to the variable and measurement tool in a meaningful way?, and does the lecturers' teaching practice scale demonstrate high separation and good reliability in person and items set?

Based on the perspective of using RM as a model in one sense in that it represents the structure which data should exhibit in order to obtain measurements from the data; i.e. it provides a criterion for successful measurement. As such, measuring the lecturers' practice needs a measurable instrument to be developed and tested in order to clarify how beliefs reform lecturers' teaching functions. Thus, this study aims to use the. RM analysis as a powerful tool for evaluating constructs validity and reliability of the instrument in order to use it for interpretation the lecturers' practice

■2.0 THEORETICAL FRAMEWORK

Teaching Practice

The issue of teaching in the education literature is discussed from the point of view of the transferring from theory to teaching practice (De Corte, 2000; Defazio, 2006, Randi and Corno, 2007; Watson, 2012; Aijaz et al, 2012). Many studies claim that to improve student learning and satisfaction can be achieved by implementing the first principles of instruction in teaching (Frick et al, 2007; Merrill, 2006, Thomson, 2002). This model of first principles of instruction of Merrill is based on a constructivism theory and other theories of teaching and learning. A principle is defined as a relationship that is always true under appropriate conditions regardless of the methods or models that implement this principle (Merrill, 2009). The principles themselves are not a model or method of instruction, but the relationships that can be the basis of any model or method. These principles can be implemented in a variety of ways by different models and methods of instruction. However, the effectiveness, efficiency and commitment to a model or method of instruction are a function of the degree to which these principles are applied. Merrill (2002) states that a principle describes a relationship that is always true under appropriate conditions regardless of program or practice. These five principles can be converted into four training phases that occur in the context of a real-world problem or task. Figure 1 illustrates four-step process guides instructional designers and educators to combine their teaching and learning activities in a manner that enhances student learning and facilitates the incorporation of new methods in the process. The process begins with the activation of students' prior learning, followed by the demonstration of new knowledge, the student's application of knowledge, and the integration of students with knowledge, all based on real-life problem or task. It further notes that it is "relationships always taken to be true under appropriate conditions regardless of program or practice '(Merrill, 2002). Therefore, this study is based on Merrill's first principle of instruction in order to develop an instrument to measure lecturer teaching practice.

Rasch Measurement Model

According to Creswell (2012), developing an instrument is more difficult than to locate one and modify it for use in a research. Thus, The RM is particularly useful in that estimates of item severities can be made independent of the level of the construct represented in a sample (Andrich, 1988). The RM, one of a group of models originating from item response theory, was initially developed in connection with the construction of ability tests. The model expresses Guttman's basic ideas in a probabilistic manner, as follows: (a) Given any item, a person of higher ability should have a higher probability of getting the item right than would a person with lower ability, and (b) given any person, an item of lower difficulty should be solved (gotten right) with a higher probability than would an item of higher difficult (Dawis, 1987). ARM is a model in one sense in that it represents the structure which data should exhibit in order to obtain measurements from the data; i.e. it provides a criterion for successful measurement. In the RM, the probability of a specified response (e.g. right/wrong answer) is modeled as a function of person and item parameters (Bond & Fox, 2007). Specifically, in the original RM, the probability of a correct response is modeled as a logistic function of the difference between the person and item parameter. RM analysis is a powerful tool for evaluating construct validity. Rasch fit statistics is indications of construct-irrelevant variance and gaps on Rasch item-person map is indications of construct under-representation.

■3.0 METHOD

Research Design

This study being a pilot study aims to test the validity and reliability of the instrument in order to measure the lecturers' teaching practice. Questionnaire was used as a survey design. The sample of this study was 103 respondents who were lecturers at CC. The questionnaire includes 30 questions divided into 5 constructs which are problem task includes 5 questions, activation includes 11 questions, demonstration includes 9 questions, application includes 8 questions, and integration includes 3 questions respectively. The RM analysis investigated the validity and reliability of the lecturers' teaching practice instrument. The questionnaire was developed based on the standards criteria of RM analysis which are item dimensionality, item polarity, item fit analysis. Calibration scale instrument was undertaken during the implementation of this study to assess the suitability of the scale of the LTP instrument. Progressive scale of five categories was used for these instruments that consist of 1 = never, 2= rarely, 3= frequently, 4= very frequently, and 5= always. Some researchers agree that the optimal length of scales needs to determine the nature of what is to be examined and the extent to which respondents can discriminate among levels (Light et al., 1990).

■4.0 RESULTS AND DISCUSSION

Quantitative data of developed LTP instrument was analyzed by using Winsteps version 3.68.2 in order to test the questionnaire items' validity and reliability. Summary of RM analysis results of the developed LTP questionnaire as followed.

Reliability Analysis

Reliability analysis was tested and conducted with 68 items for LBTF instrument, among 103 lecturers of CC in Yemen. The criteria for accepting reliability in RM is exceeding 0.50 (Linacre, 2007; Bond & Fox, 2007). In addition, acceptable separation should be more than 2 (Fisher, 2007). Reliability reports on the consistency of a respondent's answers to the items in the scale (Pedhazur & Schmelkin, 1991). The RM analysis measures reliability with person separation reliability. This statistic shows the ability of the items to separate persons with different levels of the concept measured. Rasch reliability of the items is comparable with Cronbach's alpha (CA).CA is a measure of internal consistency and estimates the reliability of the scale by computing the variance between all possible pairs of items. As shown in Table 1, the person reliability value was high with 0.91, and the person separation was 3.27. Table 4.10 showed the item reliability value was 0.83 and item separation value was 2.22. Therefore, the results of the person and item reliability and person and item separation for LTP indicated satisfactory readability.

Validity Analysis

RM analysis tested the validity LBTF and LTP based on dimensionality, item polarity, item fit, and calibration scales and as criteria for psychometric properties.

Dimensionality aspect is important for determining that the instrument is measured in one dimension and one direction (Linacre, 2003; Bond & Fox, 2007). Dimensionality aspect is used to ensure content validity and construct validity of the instrument (Wu & Adams, 2007). In RM analysis, a satisfactory dimensionality determined by raw variance explained by measures which should be more than 40% and unexplned variance in 1st contrast which should be ≤ 15. The dimensionality analysis result of LTP was illustrated in Table 3. The raw variance explained by measured value was 44.6%.0%, and unexplned variance in 1st contrast value was 6.7%%. Thus, dimensionality data results posts that the LTP data fit the RM.

Analysis of the polarity or consistency of the items are indicators used to show the items move in one direction to which the constructs. Item polarity or point measure correlation (PTMEA Corr.) was the early detection of construct validity (Bond & Fox, 2007). This analysis had the same function as factor analysis to access the relationship between the items in measuring the constructs that required. The point measure correlation (PTMEA) value should be+ 0.2 <x<1 (Fox & Bond, 2007). As shown in Table 4, all LTP items showed a positive value and greater than 0.20. Therefore, these results indicate that all items are moving in parallel function to measure the constructs formed.

According to Bond and Fox (2007), the fit mean-square (MNSQ) implies that there should not be a difference between the expected Rasch score and the observed score for each item. Infit refers to the degree of fit of an item or a person. Infit means square is transformation of the residuals, the difference between the predicated and observed for easy interoperation.). For the analysis of these constructs items, it appears in MNSSQ infit analysis value should be 0.5 <x <1.5, and PTMEA value should be positive and + 0.2 <x<1(Linacare, 2005). Also, other criteria to be considered to determine the mis fit item is the standardized fit statistic (Zstd) value with acceptable range value -2<ZSTD<+2 (Bond and Fox, 2007). The analysis of appropriateness and inappropriateness items of LBTF and LPTM, the analysis is reformed using constructs one by one. Item measure can list the logit measurement information for each item. Appropriateness of items under schedule also showed the information for mean square (MNSQ) to make it easier for outlier detection or misfit. Table 5 showed the items number I.34, A.7, D.22, I.35, I.36, and A.6 their MNSQ values were more 1.5, and ZTS values greater than the range -2 or +2. Thus, these items indicated to omit. Hence, removal of these items improved the fit analysis as illustrated in Table xxx as very good items signifying that all the items are appropriate for both further statistical analysis and inferences.

RM analysis can also help to determine the validity of the scale used to make zero calibration setting and subsequent grading scale used. RM determines the validity of the response probabilities being spread fairly across scales. RM polychromous data analysis is used to determine whether it correspondents to the model or not. Polychromous RM can also measure the hypothesis of a scale in terms of adding value to the agreement or disagreement as moving from one continuum to another continuum (Linacre, 2003; Bond & Fox, 2007). Not all scales can be used for RM. If the structure calibration is less than 1.40 and more than 5 this scale should collapse (Linacre, 2003; Bond & Fox, 2007). Scale of five categories was used for these instruments that consist of 1 = never, 2= rarely, 3= frequently, 4= very frequently, and 5= always. Some researchers agree that the optimal length of scales needs to determine the nature of what is to be examined and the extent to which respondents can discriminate among levels (Light et al., 1990).

Table 5 and Figure 2 showed a summary of the category structure on a scale gradation and size structure of the intersection of LTP. In the column arrangement observation (observed count) showed the respondents' answers given to ranking scale. As shown in Table 5, the most frequent answer was the scale of respondents ranking 4 which 1407 (46 %). The next grading scale, that respondents selected, was scale 5 of 1238 (40%). The scale 3 had 352 (11%) respondents while the least grading scale of least were scale 2 with 90(3%) respondents, and scale of 1 of 3 (0) respondents. The observed averages showed the pattern of respondents. Fairly normal pattern is expected with systematic instrument from negative to positive. As illustrated in Table 4.44, the response pattern obtained started from -.24 logit and moved up monotonously towards +4.23 logits signifying that the pattern of respondents' answers was fairly normal.

■5.0 CONCLUSION

In this study, RM analysis is used to evaluate the usefulness of several items used in the LTP as a measurement scale lecturers' teaching practice. The items are identified according to the theory and evaluated according to the RM. Thus, RM analyses was used to answer the following questions Do the items of lecturers' teaching practice scale have adequate fit statistics, showing that each item relates to the variable and measurement tool in a meaningful way? and does the lecturers' teaching practice scale demonstrate high separation and good

reliability in person and items set. Based on the results of the RM measurement; item reliability was 0.91 > 0.50, item separation was 3.19 > 2.0, dimensionality, and evaluation of RM fit (infit <1.5) resulted in LTP with good psychometric properties.

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