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A LOGISTIC REGRESSION MODEL PREDICTING ASSESSMENT LITERACY AMONG IN-SERVICE TEACHERS

(ÖĞRETMENLERİN DEĞERLENDİRME OKUR-YAZARLIĞINI
BELİRLEMEDE LOJİSTİK REGRESYON MODELİ)

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ABSTRACT

Classroom assessment research has repeatedly documented a concern about teachers' assessment literacy, which might threaten the assessment process of student learning. This study aimed at developing a model that could predict assessment literacy among in-service teachers. Variables considered in the investigation were attitude toward educational measurement, self-perceived confidence in educational measurement, in-service assessment training, gender, major, and years of teaching experience. Participants were 516 in-service teachers (259 males and 257 females) teaching middle school grades in Oman. They were selected from a random sample of 40 public schools at Muscat educational region in Oman. Logistic regression analyses revealed that attitude toward educational measurement, self-perceived confidence in educational measurement, in-service assessment training, and teaching experience were the only reliable predictors of assessment literacy. Implications for professional preparation in educational measurement as well as recommendations for future research are discussed.

Keywords: in-service teachers, assessment literacy, logistic regression, educational measurement.

ÖZ

Sınıf içi değerlendirme araştırmaları, öğrencilerin öğrenme sürecinin değerlendirmesini tehdit eden bir konu olan öğretmenlerin değerlendirme okuryazarlığı ile ilgili endişeyi sürekli olarak belgelendirmişlerdir. Bu çalışma öğretmenlerin değerlendirme okuryazarlığını belirlemede bir model geliştirmeyi amaçlamıştır. Araştırmada ele alınan değişkenler, eğitimsel değerlendirmeye ilişkin tutum, eğitimsel değerlendirmeye ilişkin öz güven algısı, hizmet içi değerlendirme eğitimi, cinsiyet, branş, ve öğretmenlik tercümesidir. Araştırmaya Oman'da ortaokul düzeyinde öğretmenlik yapan 516 öğretmen (259 bay ve 257 bayan) katılmıştır. Bu öğretmenler Oman'daki Muscat eğitim bölgesinde yer alan 40 devlet okulunda rastgele örneklem yolu ile seçilmiştir. Lojistik regresyon analizleri sadece eğitimsel değerlendirmeye ilişkin tutumun, eğitimsel değerlendirmeye ilişkin öz güven algısını, hizmet içi değerlendirme eğitimin ve öğretmenlik tercümesinin değerlendirme okuryazarlığının tahmininde güvenilir öngörüler olduğunu ortaya koymuştur. Eğitimde ölçme ve değerlendirme için mesleki hazırlanmaya yönelik çıkarımlar ve gelecek çalışmalara yönelik öneriler tartışılmıştır.

Anahtar Sözcükler: öğretmenler, değerlendirme okuryazarlığı, lojistik regresyon, eğitimsel değerlendirme.

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INTRODUCTION

A substantial part of teachers' professional time is devoted to assessment-related activities including, but are not limited to, developing assessment methods; administering, scoring, and interpreting assessment results; developing grading procedures; communicating assessment results; and using them in making educational decisions (Mertler & Campbell, 2005, Zhang & Burry-Stock, 2003). Optimal implementation of these activities requires strong knowledge and abilities in educational measurement (Alkharusi, 2009; Popham, 2006). Teachers' knowledge and abilities in educational measurement have been equated to assessment literacy (Mertler & Campbell, 2005; Popham, 2006; Volante & Fazio, 2007). It entails knowing what it is being assessed, why it is assessed, how best to assess it, how to make a representative sample of the assessment, what problems can occur within the assessment process, and how to prevent them from occurring (Stiggins, 1995). In addition, the American Federation of Teachers (AFT), the National Council on Measurement in Education (NCME), and the National Education Association (NEA) (1990) have jointly developed "Standards for Teacher Competence in Educational Assessment of Students." These standards describe the knowledge and abilities that should be possessed by teachers to be assessment literates. The standards state that teachers should be able to choose and develop appropriate assessment methods; administer, score, and interpret assessment results; use these results when making educational decisions; develop valid grading procedures; communicate assessment results to various audiences; and recognize inappropriate practices of assessment.

Moreover, in an attempt to make educational measurement training more relevant to the classroom teachers' work, several educators (e.g., Airasian, 1991; Arter, 1999; Schafer, 1991; Stiggins, 1991) have recommended certain content areas to be included in the professional preparation of teachers in educational measurement. For example, Airasian (1991) mentioned that nontraditional assessment topics such as using and improving informal assessment methods, planning instruction, critiquing instructional materials, assessing learning during instruction, and evaluating curriculum embedded tests are more important than the traditional topics covered by educational measurement courses. The inclusion of these topics in the educational measurement courses may help teachers attain a desirable level of assessment literacy that enables them "to meet the challenge of day-to day classroom assessment" (Stiggins, 1999, p. 24).

Unfortunately, studies of educational measurement have repeatedly expressed a concern about the adequacy of teachers' assessment literacy. For example, Daniel and King (1998) examined testing and measurement literacy of 95 elementary and secondary school teachers in the United States, and found that teachers' knowledge base regarding testing and measurement was

somewhat inadequate. Similarly, in a study on classroom assessment practices of 246 third preparatory science teachers in Oman, Alsarimi (2000) found that although teachers completed a substantial amount of pre- and in-service training in educational measurement, they had only a moderate understanding of educational measurement principles. Recently, in a study of 279 pre-service teachers and 233 in-service teachers from Oman, Alkharusi, Kazem, and Al-Musawai (2011) found that although in-service teachers tended to have a lower level of educational measurement knowledge, those with a pre-service training in educational measurement had a better understanding of the educational assessment concepts and principles than those without pre-service educational measurement training. However, when compared to the high experienced teachers, those having low teaching experience had a higher level of educational measurement knowledge. This might be due to their recent completion of a pre-service educational measurement coursework.

Recognizing the need for teachers to possess an adequate knowledge in educational assessment, Plake and Impara (1992) developed an instrument titled the "Teacher Assessment Literacy Questionnaire (TALQ)" consisting of 35 items to measure teachers' assessment literacy. The TALQ was based on the "Standards for Teacher Competence in the Educational Assessment" (AFT, NCME, & NEA, 1990). The instrument was administered to a sample of 555 in-service teachers around the United States. The results indicated that the teachers might not be well prepared to assess student learning as revealed by the average score of 23 out of 35 items correct. Similarly, Mertler and Campbell (2005) developed another instrument titled the "Assessment Literacy Inventory (ALI)" consisting of 35 items in alignment to the "Standards for Teacher Competence in the Educational Assessment" (AFT, NCME, & NEA, 1990). The instrument was administered to a sample of 249 preservice teachers in the United States. Like Plake and Impara's (1992) study with in-service teachers, Mertler and Campbell (2005) found that the performance of the preservice teachers on the ALI was not satisfactory as evidenced by the average score of 23.83 out of 35 items correct. These results imply that teachers' assessment literacy should deserve further recognition and investigation. The present study focuses on the in-service teachers' assessment literacy, and hence it would utilize Plake and Impara's (1992) instrument.

When comparing assessment literacy of pre-service and in-service teachers, the studies have indicated that the assessment literacy level of pre-service teachers tended to be lower than that of in-service teachers (Mertler, 2003, 2004). This suggests that an experiential base in classroom assessment might instigate the assessment literacy. Recent studies have also confirmed the importance of attitude toward educational measurement, self-perceived confidence in educational measurement, in-service assessment training, gender, and major when considering teachers' assessment literacy. For example, in his discussion of the assessment literacy, Popham (2006) asserted

the need for a continuous in-service assessment training aligned with the classroom assessment realities. In a survey of assessment literacy of 69 teacher candidates, Volante and Fazio (2007) found that the self-described levels of assessment literacy remained relatively low for the candidates across the four years of the teacher education program, and hence agreed with Popham's (2006) assertion about the need for in-service assessment training to ensure an acceptable level of assessment literacy. Along similar lines, Wolfe, Viger, Jarvinen, and Linkman (2009) proposed that teachers' self-perceived confidence in assessment should be a vital component in the professional development of in-service teachers. Further, in a survey of 211 pre-service teachers, Alkharusi (2009) found that holding favorable attitudes toward educational measurement and having a high sense of confidence in performing measurement-related tasks contributed significantly to the measurement and testing knowledge of pre-service teachers; males tended to have on average a higher level of measurement and testing knowledge than females; and that pre-service teachers specializing in academic areas such as English language, math, and science tended to possess a higher level of measurement and testing knowledge.

The common results from the assessment research point out that classroom assessment is an integral part of teaching responsibilities, but teachers' assessment literacy seems inadequate, and hence it should receive considerable scrutiny. Therefore, in an attempt to gain insights in improving teachers' assessment literacy, this study aimed at identifying variables assumed to influence assessment literacy of in-service teachers. Specifically, the study would develop a model that could predict the assessment literacy of the in-service teachers.

Research Problem and Purpose of the Study

The teachers' lack of competence in educational measurement and the demands for sound classroom assessment has led teacher educators to identify an acceptable level of assessment literacy that should be demonstrated by teachers to ensure optimal outcomes in classroom learning and instruction. It could be argued that without adequate knowledge of and strong skills in educational measurement, it is unlikely that teachers' assessment practices will lead to the desired improvements in classroom learning and instruction. Given the empirical evidence indicating the inadequacies of teachers' assessment literacy and that a formal training in educational measurement is a prerequisite for effective assessment literacy, further exploration of teachers' knowledge in educational measurement is needed. Therefore, the purpose of this study was to develop a model that explains the variation in the assessment literacy among in-service teachers. Armed with the aforementioned literature, the study investigated whether attitude toward educational measurement, self-perceived confidence in educational measurement, in-service assessment

training, gender, major, and years of teaching experience could predict the assessment literacy of the in-service teachers.

METHODS

Participants

The population of this study includes all in-service teachers teaching public middle school grades in Muscat educational region in Oman. A list of all these teachers could not be obtained from the Ministry of Education in Oman. Thus, a list of all public schools was utilized to select the sample. The list contained 72 public schools. Due to limited finances for the study, a random sample of 40 (55.56%) schools was selected. Then, all teachers in the selected schools were approached for participation. This resulted in a sample of 516 in-service teachers (259 males and 257 females) teaching middle school grades in Oman. There were 261 teachers teaching academic areas such as Arabic language, English language, mathematics, and science. There were also 255 teachers teaching non-academic areas such as fine arts, life skills, music, and physical education. Their teaching experience ranged from 1 to 15 years with an average of 5.60 and a standard deviation of 4.29. One hundred and forty six teachers indicated that they have taken at least one in-service workshop training in classroom assessment whereas 370 teachers indicated that they did not take in-service workshop training in assessment.

Instrumentation

A self-report questionnaire of four parts was used in this study. The first part was about demographic data of the participant. The other three parts were about assessment literacy, attitude toward educational measurement, and self-perceived confidence in educational measurement. To establish content validity, the questionnaire was given to a group of seven experts in the areas of educational measurement and psychology from Sultan Qaboos University. They were asked to judge the clarity of wording and the appropriateness of each item and its relevance to the construct being measured. Their feedback was used for further refinement of the questionnaire.

Assessment literacy

This part of the questionnaire consisted of 32 items from the Arabic version of the Plake and Impara's (1992) Teacher Assessment Literacy Questionnaire (Alkharusi, Kazem, & Al-Musawai, 2010). It assesses teachers' knowledge and understanding of basic principles of sound classroom assessment practices, terminology, development, and use of various classroom assessment methods. All items followed a multiple-choice format with four options, one being the correct answer. Item difficulty values across all items ranged from .35 to .81 and item discrimination values ranged from .30 to .56.

The KR20 reliability coefficient for the scores was .80. In order to identify teachers with an acceptable level of assessment literacy, the group of experts was asked to suggest a cutting score for the desirable level of assessment literacy. The majority of the experts suggested that answering 75% of the items correctly from the Teacher Assessment Literacy Questionnaire would represent the acceptable level of assessment literacy. This corresponds to obtaining a score of 24. Based on this criterion, 317 teachers were identified as having an acceptable level of assessment literacy whereas 199 teachers were identified as having an unacceptable level of assessment literacy.

Attitude toward Educational Measurement

This part of the questionnaire contained 29 items from the Arabic version of the Bryant and Barnes's (1997) Attitude toward Educational Measurement Inventory (Alkharusi, 2010). Responses were obtained on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Scoring of the negative items was reversed so that a high score reflected a more positive attitude towards educational measurement. An individual's attitude towards educational measurement was represented by an average rating score across all the items. Internal consistency reliability coefficient was .92 as measured by Cronbach's alpha.

Self-perceived Confidence in Educational Measurement

This part of the questionnaire contained 54 items from Alkharusi's (2009) Self-Confidence Scale in Educational Measurement designed to assess teachers' perceptions of confidence in their abilities to perform certain educational measurement tasks related to teacher-made tests, statistics, item analysis, reliability, and validity of teacher-made tests, performance and portfolio assessment, and communicating assessment results. Responses were obtained on a 4-point Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*) with high scores reflecting a high sense of confidence in educational measurement. An individual's self-perceived confidence in educational measurement was represented by an average rating score across all the items. Internal consistency reliability coefficient was .94 as measured by Cronbach's alpha.

Procedures

Permission was requested from school principals to collect data from the teachers. The participants were informed that a study is being conducted to investigate possible predictors of the assessment literacy among in-service teachers. The teachers were also informed that they were not obligated to participate in the study, and that if they wished, their responses would remain anonymous and confidential. Those who wished to participate in the study were provided a cover letter and the questionnaire along with brief instructions

about the information that was requested in the questionnaire, how to respond to the items, and where to find directions that were also included both on the cover letter and the questionnaire. In addition to the demographic information, the items of the questionnaire were divided into three parts: assessment literacy, attitude toward educational measurement, and self-perceived confidence in educational measurement. The author and two research assistants administered the questionnaires to the participants in each school in one seated session for two hours.

Analysis

The dependent variable in this study was a binary outcome: having or not having an acceptable level of assessment literacy. Therefore, a logistic regression analysis was utilized to investigate the relationship between assessment literacy and several predictor variables. These variables were attitude toward educational measurement, self-perceived confidence in educational measurement, in-service assessment training, gender, major, and years of teaching experience. The assessment literacy was coded "0" for an unacceptable level of assessment literacy and "1" for an acceptable level. The gender was coded "0" for female teachers and "1" for male teachers. The major was coded "0" for non-academic majors such as fine arts, life skills, music, and physical education; and "1" for academic majors such as Arabic language, English language, mathematics, and science. The in-service assessment training was coded "0" for not having in-service assessment training and "1" for having at least one in-service assessment training. The attitude toward educational measurement, self-perceived confidence in educational measurement, and years of teaching experience were treated as continuous variables. The significance of the predictors was evaluated using the Wald criterion at .05 level of significance. Preliminary analyses show no concern regarding missing data, ratio of cases to variables, independence of errors, multicollinearity, linearity, and outliers.

RESULTS

A logistic regression analysis was conducted to investigate whether attitude toward educational measurement, self-perceived confidence in educational measurement, in-service assessment training, gender, major, and years of teaching experience predicted assessment literacy of in-service teachers. Table 1 summarizes results of the regression analysis predicting assessment literacy. Results showed that the proposed full model predicted the data well, $\chi^2(6) = 82.592, p < .001$; with an overall prediction success rate of 70.7%. The prediction success rates were 85.5% for teachers having an

acceptable level of assessment literacy and 56.4% for those having an unacceptable level of assessment literacy.

Table 1. Summary of Logistic Regression Predicting Assessment Literacy

Variable	B	SE	Odds ratio	Wald statistic
In-service assessment training	2.570	.457	13.066	5.624***
Attitude toward educational measurement	1.859	.223	6.417	8.336***
Confidence in educational measurement	1.519	.207	4.568	7.338**
Teaching experience	-.114	.044	.892*	- 2.591*
Gender	.184	.207	1.202	0.889
Major	-.037	.201	.964	- 0.184

Note. Cox & Snell $R^2 = .448$. Nagelkerke $R^2 = .501$.

* $p < .05$. ** $p < .01$. *** $p < .001$.

As shown in Table 1 and according to the Wald criterion, teachers with in-service assessment training were 13.066 times more likely to have an acceptable level of assessment literacy than those without in-service assessment training. In regard to attitude toward educational measurement, the odds of having an acceptable level of assessment literacy increased by a factor of 6.417 with every one-point increase in the 5-point attitude toward educational measurement scale. In addition, a one-point increase in the 4-point self-perceived confidence scale in educational measurement was associated with a teacher being 4.568 times more likely to have an acceptable level of assessment literacy. In addition, a one-year increase in the teaching experience was associated with a teacher being .892 times less likely to have an acceptable level of assessment literacy. Gender and major were not significantly associated with assessment literacy. In addition, a model run with in-service assessment training, attitude toward educational measurement, self-perceived confidence in educational measurement, and years of teaching experience omitted was not reliably different from a constant-only model. However, this model was reliably different from the full model, $\chi^2(4) = 76.007$, $p < .01$. This confirms the finding that in-service assessment training, attitude toward educational measurement, self-perceived confidence in educational measurement, and years of teaching experience were the only reliable predictors of the assessment literacy among the six variables considered in the present study.

DISCUSSION

As assessment of student learning plays a key role of classroom teachers' responsibilities (Mertler & Campbell, 2005), teachers are expected to be competent in educational assessment (AFT et al., 1990; Popham, 2006). For many years, educational researchers have maintained a concern about the adequacy of teachers' assessment literacy (e.g., Daniel & King, 1998; Mertler, 2003, 2004; Volante & Fazio, 2007). This study represented a unique attempt to determine the combined effects of certain variables assumed to be related to the assessment literacy of the teachers. Findings from the study suggested that in-service assessment training, attitude toward educational measurement, self-perceived confidence in educational measurement, and years of teaching experience provide the best model for explaining differences in the assessment literacy among in-service teachers.

The findings that in-service assessment training was positively related to and that years of teaching experience were negatively related to assessment literacy are consistent with previous research in this area (Alkharusi et al., 2011; Daniel & King, 1998). These findings confirm the calls for continuous in-service training in the knowledge and use of assessment methods for teachers (Popham, 2006; Volante & Fazio, 2007). As stated by Stiggins and Bridgeford (1985, p. 285), "In-service training, structured to meet teachers' assessment needs, provides the greatest opportunity for impact...[This] training must focus on real teachers needs and provide guidance in quality control for all teacher-made tests, including those based on observation and subjective judgments". Thus, the findings of this study reveal that further attention may need to be devoted to improving the assessment literacy of the teachers through continuous in-service assessment training.

Findings from this study regarding the effects of attitude toward educational measurement and self-perceived confidence in educational measurement support those investigations, which reported positive relationships between affective-related variables and assessment literacy (Ogan-Bekiroglu, 2009; Volante & Fazio, 2007; Wolfe et al., 2007). Together these findings suggest that an increase in self-confidence about measurement and testing tasks, as well as holding positive attitudes toward educational measurement, might contribute to an increased likelihood of having a desirable level of assessment literacy. Theoretically, assessment competence could be enhanced when the assessment tasks are perceived to be useful and relevant to the daily classroom practices, and that the teacher feels confident that he or she is successfully capable in performing those tasks (Alkharusi, 2010; Kushner, Carey, Dedrick, & Wallace, 1995). Perhaps the most obvious implication of these findings is the recommendation that teacher educators need to clarify both the relevance and importance of educational measurement for sound day-to-day classroom assessment and to give prospective teachers

opportunities to practice measurement and testing principles in order to have a sense of confidence in their assessment abilities.

Finally, the model of assessment literacy found in this study requires further consideration. Future research should be conducted to ascertain whether the model reached in this study apply to preservice teachers as well. In addition, teachers are often confronted with the task of fulfilling responsibilities associated with multiple roles in the school (Mertler, 2004), and as such they may not be able to devote sufficient time and effort toward assessment-related tasks. When this does occur, it might not be uncommon to observe a decline in their assessment literacy. Therefore, it would be beneficial to investigate the influence of other variables such as inter-role conflict in order to reach a more complete understanding of the teachers' assessment literacy.

The generalizability of the current study's findings might be limited by the use of self-report questionnaires and by the participating sample of teachers. Future research may need to use multiple data collection methods including teachers' lesson and assessment plans, classroom observation, and interviews with students to validate the self-report questionnaires. In addition, the instruments may need to be administered to a more representative sample selected from different geographic regions across the country.

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