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Procedia Social and Behavioral Sciences 5 (2010) 5–11

Procedia
Social and Behavioral Sciences

WCPCG-2010

A multilevel linear model of teachers' assessment practices and students' perceptions of the classroom assessment environment

Hussain Alkharusi^a *^a*Sultan Qaboos University, P.O.Box 32, Alkhoud Postcode 123, Oman*

Received January 14, 2010; revised February 6, 2010; accepted March 29, 2010

Abstract

This study utilized multilevel linear modeling techniques to examine the effects of teachers' assessment practices on students' perceptions of the classroom assessment environment. A total of 1,636 ninth grade students and their corresponding 83 science teachers participated in the study. Results showed that students' perceptions of the assessment environment were shaped by student characteristics such as self-efficacy; class contextual features such as aggregate perceived assessment environment and average self-efficacy levels of the class; teacher's teaching experience and assessment practices; and interaction of student characteristics, class contextual features, and teacher's assessment practices. Implications for research and practice are discussed.

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Keyword: Assessment environment, assessment practices, students' perceptions, classroom environment, classroom assessment.

1. Introduction

Classroom assessment involves a wide range of activities from designing paper-pencil tests and performance measures to grading, communicating assessment results, and using them in decision-making (Zhang & Burry-Stock, 2003). Although there is a great deal of research on teachers' assessment practices, few empirical research attempts have been made to link these practices to students' perceptions of classroom assessment environment. Theoretically, perceived classroom assessment environment refers to the overall meaning that students make out of the various teachers' assessment practices in the classroom (Brookhart & DeVoge, 1999). Operationally, it has been represented by two dimensions: learning- and harsh-oriented assessment environments (Alkharusi, 2008; Ozdamli, 2009). The learning-oriented environment refers to the extent to which students perceive assessment tasks as moderately challenging, assessment standards and criteria are clear, assessment feedback is informative, and that they have chances to improve their performance. The harsh-oriented environment refers to the extent to which students perceive that the assessment tasks and grading are difficult, greater importance is given to the grades than learning, and that the evaluation and recognition practices are public highlighting social comparison. Given that a substantial proportion of classroom time is devoted to the assessment of student learning and that students' perceptions of the meaning of the classroom activities play a critical role in the learning process, it seems reasonable to argue that the

* Hussain Alkharusi. Tel.: +968-96222535; fax: +968-24413817.

E-mail address: husseini5@squ.edu.om.

impact of teachers' assessment practices on students' perceptions of the classroom assessment environment deserve recognition and investigation.

1.1. Purpose of the study

Having identified the dimensions of student perceived assessment environment, this study sought to find out what student and class characteristics are related to students' perceptions of the classroom assessment environment? The objects of interest and measurement in this study were students and teachers and as such multilevel modeling (Raudenbush & Bryk, 2002) is the appropriate analytic technique to handle the nested nature of the data. This kind of investigation may contribute to the understanding of both theory and practice of classroom assessment, and could provide a road sign for improving the learning and assessment climate in the classroom.

1.2. Academic self-efficacy and gender

Academic self-efficacy and gender have been detected as potential correlates of students' perceptions of the classroom assessment environment. Academic self-efficacy refers to students' judgments of their capabilities to successfully perform specific tasks (Bandura, 1997). Research has shown that students with a high sense of self-efficacy tended to hold more positive perceptions of their classroom environment than students with a low sense of self-efficacy (Greene, Miller, Crowson, Duke, & Akey, 2004). Also, females have been found to report more positive perceptions of their classroom environment (Meece, Herman, & McCombs, 2003) and tended to hold stronger self-efficacy beliefs than males (Britner & Pajares, 2006). It should be noted that gender in this study varied across classes because in Oman, students within the same class and their teacher are of the same gender, either all of them are males or all of them are females. Therefore, unlike past research studies, gender in the present study would more appropriately to be treated as an independent variable at the class-level. Thus, the multilevel modeling approach to account for the gender effects would be applied in this study by assuming that student self-efficacy is a confounding variable in the within-class model and that the composition of students in each class (i.e., class average for self-efficacy) and its interaction with class gender are confounding variables in the between-class model.

1.3. Aggregate perceived classroom assessment environment

Students within a classroom share common characteristics of the teacher and his or her assessment practices, and as such even though students respond differently to the same classroom assessment process, their responses may have commonality. Yet, research on classroom environment research has used individual student scores as the unit of analysis rather than the average score of students at the classroom level (e.g., Church, Elliot, & Gable, 2001; Kaplan, Middleton, Urdan, Midgley, 2002). Proponents of this approach argue that students within the same classroom differ in how they interpret and perceive the various practices in the classroom as a result of differential treatment and their different prior experiences brought to the classroom (Ames, 1992; Kaplan et al., 2002). Since students in the classroom "are not social isolates of the influence of those around them" (Bandura, 1997, p. 469), it seems reasonable to argue that the aggregate perceived classroom assessment environment might act as a cogent attribute to characterize the social influence of the classroom. Therefore, the present study would attempt to address the question of how is the aggregate perceived assessment environment as an emergent attribute of the classroom related to differences in individual perceived assessment environment as a student-level attribute.

1.4. Teachers' assessment practices

Teachers' uses of different forms of assessment methods (traditional vs. alternative assessments) represent one facet of the classroom assessment environment (Brookhart, 1997). However, little empirical research (e.g., Maslovaty & Kuzi, 2002) exists about the effects of teacher's use of a particular form of assessment on the classroom assessment environment as perceived by students. Furthermore, although teachers are expected to conduct classroom assessment practices that are in agreement with those recommended by experts of educational assessment (American Federation of Teachers, National Council on Measurement in Education, & National Educational Association, 1990), considerable amount of research (e.g., McMillan, Myran, & Workman, 2002;

Mertler, 1999) have shown that teachers' assessment practices are often not consistent with the recommended practices. However, empirical studies in the classroom assessment literature investigating how the use of recommended classroom assessment practices affects students' perceptions of the classroom assessment environment are extremely limited. The present study would attempt to address this question in relation to teachers' teaching experience.

2. Methods

2.1. Participants and procedures

A total of 1,636 students and their corresponding 83 science teachers in the ninth grade participated in the study. The number of participating students in each class ranged from 14 to 21 with an average of 20 students. Of all participating students, 735 were males and 901 were females. Of all participating teachers, 37 were males and 46 were females. The teaching experience of the teachers ranged from 1 to 13.5 years with an average of 5.20 and a standard deviation of 2.64. Permission for the study was granted by the Ministry of Education in Oman. The data collection process took place during a regular scheduled class meeting. The participants were informed that they were not obligated to participate in the study, and if they wished to participate in the study, their responses would remain anonymous and confidential.

2.2. Instrumentation

Two questionnaires were developed and used for this study, one for students and one for teachers. The student's questionnaire included items focusing on perceived learning assessment environment (five items, $\alpha = .63$), perceived harsh assessment environment (six items, $\alpha = .60$), and academic self-efficacy (six items, $\alpha = .74$). The students were asked to indicate the extent to which each item is true or not true for them in the ninth grade science class using a 4-point Likert scale ranging from 1 (*completely not true*) to 4 (*completely true*). The teacher's questionnaire included items focusing on teacher's frequent uses of traditional assessments (seven items, $\alpha = .69$), alternative assessments (six items, $\alpha = .61$), and various assessment practices recommended by experts of educational assessment (30 items, $\alpha = .65$). The teachers were asked to indicate the extent to which they use each type of the assessment practices on a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*). In addition, a section about demographic data was included at the end of each questionnaire to describe the sample. Detailed descriptions regarding the development and validation process of the questionnaires can be found in Alkharusi (2008).

2.3. Data Analysis

A multilevel modeling technique (Raudenbush & Bryk, 2002) was conducted on each dimension of the perceived assessment environment. The modeling process began with a fully unconditional model followed by a random-coefficient regression model and intercepts-and-slopes-as-outcomes regression models. Next, the analyses involved combining together the statistically significant class-level variables to produce a parsimonious overall model for each dependent variable. The validity of inferences based on the final model was assessed by verifying the tenability of the multilevel modeling assumptions (Raudenbush & Bryk, 2002, p. 255). In this study, only the results of the final models are presented. Readers are invited to contact the author for details about the analysis.

3. Results

3.1. Modeling perceived learning classroom assessment environment

Table 1 presents results of the final reduced composite model of perceived learning assessment environment. As shown in Table 1, the average self-efficacy of students was positively related to class mean perceived learning assessment environment. Also, the effect of class gender on class average perceived learning assessment

environment depended significantly on teacher's frequent use of alternative assessments. Specifically, in classes using alternative assessments more frequently, the average perceived learning assessment environment was higher in female classrooms. The opposite was true in classes using alternative assessments less frequently, in that, the average perceived learning assessment environment was higher in male classrooms. Using the random-coefficient regression model as the base model, approximately 69% of the variance among classrooms in average perceived learning assessment environment was explained once class gender, class average self-efficacy, class average perceived harsh assessment environment, frequent use of alternative assessments, and interaction of class gender-by-frequent use of alternative assessments were taken into account. With regard to self-efficacy slope, perceptions of high efficacious students about their classroom assessment environment as being learning-oriented were on average not only higher; $\hat{\gamma}_{10} = .265$, $t(1629) = 9.430$, $p < .001$; but also less variable; $\hat{\alpha}_1 = -.149$, $z = 3.873$, $p < .001$; than those for less efficacious students.

Table1. Final reduced composite model of perceived learning assessment environment with heterogeneous level-1 variance

Fixed effect	Coefficient	SE	t-value
Class PLAE mean, β_{0j}			
Base, γ_{00}	.075	.037	2.022*
GNDR, γ_{01}	-.677	.166	4.080***
ALTR, γ_{02}	.011	.027	.394
CEFC, γ_{03}	.129	.036	3.554**
CPHAE, γ_{04}	-.163	.031	5.208***
GNDR \times ALTR, γ_{05}	.705	.168	4.200***
SEFC slope, β_{1j}			
Base, γ_{10}	.265	.028	9.430***
Random effect	Variance component	df	χ^2
PLAE mean, u_{0j}	.0359	77	155.901***
Model for level-1 variance			
Parameter	Coefficient	SE	z-value
Intercept, α_0	-.206	.036	5.738***
SEFC, α_1	-.149	.038	3.873***

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

Note. PLAE = perceived learning assessment environment. GNDR = class gender (1 = female and -1 = male). ALTR = teacher's frequent use of alternative assessments. CEFC = class average self-efficacy. CPHAE = class average perceived harsh assessment environment. SEFC = student self-efficacy.

3.2. Modeling perceived harsh classroom assessment environment

Table 2 presents results of the final fitted explanatory model of perceived harsh assessment environment. As shown in Table 2, the average perceived learning assessment environment was negatively related to class mean perceived harsh assessment environment. Using the random-coefficient regression model as the base model, approximately 37% of the variance among classrooms in average perceived harsh assessment environment was explained by class average perceived learning assessment environment. With regard to the self-efficacy slope, on average, student self-efficacy was negatively related to perceived harsh assessment environment within classrooms. Also, there was a statistically significant contextual effect in the data for the relationship between student self-efficacy and perceived harsh assessment environment. Specifically, the relationship between student self-efficacy

and perceived harsh assessment environment tended to be stronger in classes with a low average self-efficacy than in classes with a high average self-efficacy. Further, student's self-efficacy tended to have a weaker effect on perceived harsh assessment environment in classes with a high adherence to the recommended assessment practices than in classes with a low adherence to the recommended assessment practices. In addition, the differentiating effect of student self-efficacy on perceived harsh assessment environment within a classroom depended jointly on class gender, teacher's teaching experience, and teacher's frequent use of alternative assessments. Specifically, in both classes having a high experienced teacher using alternative assessments more frequently and classes having a low experienced teacher using alternative assessments less frequently, female classrooms were less differentiating with regard to student self-efficacy than were male classrooms, holding other factors constant. The opposite was true in both classes having a high experienced teacher using alternative assessments less frequently and classes having a low experienced teacher using alternative assessments more frequently, in that, female classrooms were more differentiating with regard to student self-efficacy than were male classrooms, holding other factors constant. After controlling for class gender, class average self-efficacy, teaching experience, frequent use of recommended assessment practices, frequent use of alternative assessments, and interaction of class gender-by-teaching experience-by-frequent use of alternative assessments; no significant variation remained unexplained in the relationship between student self-efficacy and perceived harsh assessment environment.

Table2. Final reduced composite model of perceived harsh assessment environment

Fixed effect	Coefficient	SE	t-value
Class PHAE mean, β_{0j}			
Base, γ_{00}	-.001	.043	.024
CPLAE, γ_{01}	-.264	.051	5.151***
SEFC slope, β_{1j}			
Base, γ_{10}	-.185	.025	7.481***
GNDR, γ_{11}	-.062	.051	1.203
CEFC, γ_{12}	-.053	.022	2.415*
RECOM, γ_{13}	-.072	.029	2.472*
ALTR, γ_{14}	.032	.031	1.028
TEXP, γ_{15}	.018	.026	.689
GNDR \times TEXP, γ_{16}	.529	.148	3.572**
GNDR \times TEXP \times ALTR, γ_{17}	-.452	.155	2.907**
Random effect			
	Variance component	df	χ^2
PHAE mean, u_{0j}	.1165	81	317.604***
Level-1 effect, r_{ij}	.7829		

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

Note. PHAE = perceived harsh assessment environment. CPLAE = class average perceived learning assessment environment. SEFC = student self-efficacy. GNDR = class gender (1 = female and -1 = male). CEFC = class average self-efficacy. RECOM = teacher's frequent use of recommended assessment practices. ALTR = teacher's frequent use of alternative assessments. TEXP = teacher's teaching experience.

4. Discussion and Conclusion

This study utilized multilevel linear modeling techniques to examine the effects of teachers' assessment practices on ninth grade students' perceptions of the classroom assessment environment. The results showed that students' perceptions of the assessment environment were shaped by student characteristics such as self-efficacy, class

contextual features such as aggregate perceived assessment environment and self-efficacy levels of the class, and teacher's teaching experience and assessment practices. These results point to a conclusion that "classes have an assessment 'character' or environment" that originates from the teacher's assessment practices, and that "students construct their own meaning [of the classroom assessment environment] based in part on their group experiences" (Brookhart, 2004, pp. 444 – 445). Therefore, researchers studying classroom environment may need to consider not only the individual student perception of the assessment environment which is referred to by Maehr and Midgley (1991, p. 405) as the "psychological environment", but also the aggregate perceptions of students in a class about their classroom assessment practices which is referred to as the "objective environment" (Church et al., 2001, p. 44).

The findings that self-efficacy was positively related to perceived learning assessment environment and negatively related to perceived harsh assessment environment seem plausible and agree with previous research findings (e.g., Brookhart & Bronowicz, 2003; Brookhart & DeVoge, 1999). According to the social cognitive theory (Bandura, 1986; Deemer, 2004), high efficacious students tend to persist in the face of difficulty, seek moderately challenging learning situations, and view failures as learning opportunities. All these aspects are theoretically consistent with the perceived learning assessment environment specified in this study. In contrast, low efficacious students tend to show little persistence with difficult tasks, try to avoid challenging achievement experiences, and may view failures as lack of ability. All these aspects are theoretically consistent with the perceived harsh assessment environment specified in this study.

Further, the present study extends previous research findings by suggesting that class gender, teacher's teaching experience, and assessment practices may be possible explanations for the relationship between self-efficacy and perceived assessment environment. First, the findings of this study showed that the negative effect of self-efficacy on perceived assessment environment tended to be strengthened in classes with a low adherence to the recommended assessment practices, thereby demonstrating how important assessment practices recommended by educational assessment experts are for desirable classroom learning environment. Second, the findings of this study showed that the negative effect of self-efficacy on perceived assessment environment tended to be weakened in male classes having a high experienced teacher than in male classes having a low experienced teacher. The opposite was found true in female classes. In light of teaching efficacy research (e.g., Daugherty, 2005; Deemer, 2004), the sampled high experienced male teachers and low experienced female teachers in this study might have high levels of teaching efficacy defined as strong beliefs about their capabilities to help students learn (Stipek, 2002), which in turn might be responsible for weakening the negative effect of student self-efficacy on perceived assessment environment in their classes. The implications of these findings for theory and practice are that given that the classroom assessment environment is often structured by the teacher (Brookhart, 1997) in the sense that classroom assessment is, to a large extent, a teacher-centered activity, teacher's psychological belief systems may influence their views and practice about certain aspects of the classroom assessment. Therefore, changing classroom assessment environment as perceived by students may require considering not only students' self-efficacy, but also teachers' teaching experience, self-beliefs and goals for students' learning, and their adherence to the recommended assessment practices.

Finally, the generalizability of this study's findings may be limited by the use of self-report questionnaires and by the particular participating sample of students and teachers. Future research should be conducted to testify the findings from this study in various subject areas and grade levels using mixed-methods research design.

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