PUBLIC SCHOOL TEACHERS' CONCEPTIONS OF TEACHING, LEARNING, AND ASSESSMENT

[1]DORIT ALT, [2]NIRIT RAICHEL

Education and Community Department, Kinneret College on the Sea of Galilee, Israel
Education and Community Department, Kinneret College on the Sea of Galilee, Israel
Email: doritalt@014.net.il, niritraichel@gmail.com

Abstract— This study assessed science teachers' conceptions of traditional teaching and learning, attitude towards using tests, and use of formative versus summative assessment tasks. Data were gathered from 127 public primary school science teachers. According to the results, most of the teachers were found supportive of the traditional teaching approach and held a positive attitude towards using tests. Moreover, the highly reported tasks the teachers used were tests and quizzes. Partial Least Squares-Structural Equation Modeling (PLS-SEM) results pointed to the mediating role of teachers' positive attitudes towards tests in linking their belief in traditional teaching to increased summative assessment task usage.

Index Terms— teachers' perceptions; science education; formative and summative assessment; Partial Least Squares-Structural Equation Modeling (PLS-SEM)

INTRODUCTION

Evidence has been amassed over the past 40 years indicating the centrality of teachers' lives, beliefs, and values in their professional development (Beauchamp et al., 2015). The way teachers use their beliefs about knowledge and learning to teach and the beliefs they bring to their professional experience may serve as barriers or facilitators of learning, shape their practice, and serve as heuristics for teachers embedded in the ever-changing contexts of classrooms (Fives & Buehl, 2016). The huge shift from traditional to constructivist approaches in science education context has turned research on teachers' conceptions of teaching and learning into a valuable avenue that may shed light on educational practices connected to those conceptions.
This study is focused on the new curriculum of science and technology education for primary and secondary schools in Israel (Center for the Advancement of Scientific and Technological Education [CASTE], 2007; Israeli Ministry of Education, 2015) which has been adapted to include student-centered approaches, and stresses the relationships between innovative teaching methods, learning activities and adaptive assessment approaches. This work may illuminate possible challenges posed by the introduction of the new science curriculum with regard to the teaching and learning underlying assumptions and goals, teaching approaches and methods of assessment.

Objectives

This study aims at assessing science teachers' conception of traditional teaching and learning as a precursor to their attitude towards using tests, and their use of formative versus summative assessment tasks. The following hypotheses will be tested:

1. It is expected that merely low levels of science teachers' traditional conceptions of teaching and learning will be reported, the extent of their positive attitudes towards using final tests will be found low, and more formative than summative assessment tasks will be used in their classes (*H1*).
2. The connection between teachers' conceptions of traditional teaching and learning, attitude towards using tests, and actual use of formative vs. summative assessment tasks, will be tested. It is expected that: *(H2)* Teachers who believe in traditional teaching will also hold more positive attitudes towards tests, and report using summative assessment tasks than formative assessment tasks.

METHODOLOGY

Participants

Data were gathered from 127 primary school science teachers from 60 Israeli public schools (73% female teachers). The seniority level mean result of the teachers was 12.9 years (*SD* = 8.3). The most frequent age category reported by the participants was 30 - 35 years (27.8%), the second frequent category was 25 - 30 (20.6%). With regard to educational attainment, 78% reported having a *bachelor's degree* and 22% *a master's degree*.

Instruments

The Teaching and Learning Conceptions questionnaire (TLCQ). This scale was developed by Chan and Elliott (2004). The scale measures two different conceptions of the teaching/learning nexus. These may be referred to as *traditional* and *constructivist*. The current study used only the *traditional* construct. Based on the original study's factor loading results, indicators with factor loadings lower than 0.40 were not selected for the current study to create a more valid and reliable assessment of the factor. Only eight items were included in the questionnaire, for example: 'A teacher's major task is to give students knowledge/information, assign them drill and practice, and test their recall'. Loading results ranged from 0.52 to 0.71. The scaling of this instrument was a 5-point Likert-style format ranging from 1= *strongly disagree* to 5= *strongly agree*. (α = .77).

Teachers' attitudes towards tests. This scale was specifically designed for the purposes of the current study. A pilot test was conducted with 42 primary school teachers who were asked to shortly convey their attitudes towards standardized tests. An inductive approach was employed to analyze the data. All descriptions without consensus were discarded from the analysis. Descriptions that were identified as unclear or too similar to another description were omitted. As a result of this process, the number of descriptions was reduced from 42 to 10. The descriptions were formulated as short statements by two experts. The wording of items identified by a pilot group (24 primary school teachers) to be problematic was refined to improved readability. Once refined, further consultation with the experts was sought to ensure that the items were still meaningful within the content of the scale description. Consequently, the final scale included six items on a 5-point Likert scale 1 = *strongly disagree to* 5 = *strongly agree*. Sample items are: 'Tests are indeed the best tools for teachers to assess student achievement'; 'Tests truly measure what my students know' ($\alpha = .75$).

Assessment tasks. The teachers were given a list of tasks that are recommended by the formal teacher's guide for science education in primary schools to be evaluated by means of formative assessments (e.g., writing research papers or conducting observations), and students' performance on tasks evaluated by summative assessment (tests and quizzes). They were asked to report the extent to which they used these assessment methods (on a five-point Likert scale of 1= *almost never to* 5= *almost always)* when determining the student final grade. Based on the new curriculum of science education for elementary schools in Israel (CASTE, 2007; Israeli Ministry of Education, 2015), seven assessment tools were listed, tests and quizzes are based on summative assessment whereas all the others relate to formative assessment:

Tests and quizzes

1) Research papers
2) Observations
3) Experiments
4) Models built by the student
5) Simulation games (in the classroom or by using a computer)
6) Scientific texts, written by the student

Data Analysis

Partial Least Squares Structural Equation Modeling (PLS-SEM; Hair, Hult, Ringle, & Sarstedt, 2017) was used. PLS-SEM is suggested to be used in situations where theory is less developed, and if the main objective of applying structural equation modeling is prediction of target constructs. SmartPLS 3 software was used.

Research Procedure

The scales were administered to the participants by research assistants. The teachers were told that the purpose of the study was to examine their attitudes towards science teaching, learning, and assessment. Prior to obtaining participants' consent, it was specified that the questionnaires were anonymous and that no pressure would be applied should they choose to return the questionnaire unfilled or incomplete. Finally, participants were assured that no specific identifying information about their schools or classes would be processed.

RESULTS

First Research Hypothesis

As above-mentioned, both the *TLCQ* and the Positive Attitudes towards Tests scales had a 5-point Likert scale 1 = *strongly disagree to* 5 = *strongly agree.* In order to assess *H1*, these scales were recorded as 1 = *high to low levels of disagreement* $\leq$ 2.5, and 2 = *low to high levels of agreement* $\geq$ 2.5. According to the results, only 8.7% of the participants reported holding negative attitudes towards traditional teaching, whereas 91.3% were found supportive of this teaching approach. The results for Positive Attitudes towards Tests indicated that most of the teachers (96.9%) held a positive attitude towards using tests. Figure 1 presents the mean distribution of assessment tasks used by the participants, showing that the highly reported tasks the teachers used were tests and quizzes. *H1* was clearly not corroborated.

Second Research Hypothesis

In order to assess *H2*, a path model was constructed. The model included four latent constructs represented in the model as cycles: Traditional Teaching, Positive Attitudes towards Tests, Summative Assessment Tasks, and Formative Assessment Tasks.

In PLS-SEM, single-headed arrows, as shown between the constructs, are considered predictive relationships, and with strong theoretical support, can be construed as causal relationships. In the model, paths were specified from the Traditional Teaching and Positive Attitudes towards Tests latent constructs to Summative and Formative Assessment Tasks constructs. Another path was specified between Traditional Teaching and Positive Attitudes towards Tests constructs. The PLS-SEM analysis used path weighting scheme and a mean value replacement for missing values.

The model evaluation included several steps. First, collinearity was examined by Variance Inflation Factor (VIF) values of all sets of predictor constructs in the structural model. The results showed that the VIF values ranging from 1.000 to 1.337. Therefore, collinearity among the predictor constructs is not a critical issue in this structural model. Next, the coefficient of determination (R^2) value was examined. R^2 for Positive Attitudes towards Tests was weak (0.252), a relatively lower R^2 value was found for Summative Assessment Tasks (0.134). The lowest result was indicated for the Formative Assessment Tasks construct (0.049).

The change in the R^2 value when a specified exogenous construct is omitted from the model was

used to evaluate its impact on the endogenous constructs. According to the results, Traditional Teaching had a relatively large effect size of 0.337 on Positive Attitudes towards Tests; the latter had a medium effect size of 0.146 on Summative Assessment Tasks; Traditional Teaching and Positive Attitudes towards Tests had small effect sizes of 0.050 and 0.023 on Formative Assessment Tasks; and lastly, Traditional Teaching had a very small effect size of 0.013 on Summative Assessment Tasks.

To test the direct/indirect effects we run the bootstrap routine. The results showed significant direct connections merely between Traditional Teaching and Positive Attitudes towards Tests, and between the latter and Summative Assessment Tasks. A significant indirect effect was found between Traditional Teaching and Summative Assessment Tasks through Positive Attitudes towards Tests. These results point to the mediating role of Positive Attitudes towards Tests in linking these constructs.

It can also be concluded that Positive Attitudes towards Tests fully mediates the relationships between Traditional Teaching and Summative Assessment Tasks, given the non-significant direct coefficient result found between the latter constructs. With regard to the teacher characteristic variables, none of them was found significantly connected to the Traditional Teaching factor.

DISCUSSION

The results showed that most of the teachers supported using traditional teaching and tests, and reported using summative assessment tasks more frequently than formative assessment tasks. PLS-SEM results showed that science teachers' belief in traditional teaching increased their positive attitudes towards tests insofar as they are linked to increased positive attitude towards using tests. These results can be explained by Watt (2005) who asserts that assessment in science education has traditionally been measurement-driven, using assessment not only to rank students but also to keep accountability of the educational system.

The present work features several limitations that merit a mention and opens avenues for future research. For example, because tests are commonly used traditional assessment instruments as reported by the teachers in this study, further observations should be gathered to explore the underlying precursors of this behavior, other than perceptions, for example, the perceived subjectivity of tests, or inadequate time frames allocated for teachers to execute perceived time-consuming formative tasks.

Indeed, the positive attitudes of teachers towards tests might be rooted in their possible concern regarding the perceived subjectivity of alternative assessment methods. However, practices such as criteria and rubrics development prior to the students' assignments might define the standards for acceptable performance and might increase the level of the formative assessment process reliability, validity, and transparency, and thus might be more acceptable among science teachers. Such methods might delineate consistent assessment criteria, as they allow both teachers and students to assess criteria which are complex and subjective. These methods may facilitate a more accurate and fair assessment by creating a community of shared practice where nothing of the assessment process is hidden from students and they can assess their own practice.

REFERENCES

[1] Beauchamp, G., Clarke, L., Hulme, M., Jephcote, M., Kennedy, A., Magennis, G.,... Peiser, G. (2015). *Teacher education in times of change*. Policy Press: Bristol.

[2] Center for the Advancement of Scientific and Technological Education [CASTE]. (2007). Science and technology for grade 1 / grade4. Teacher's guide. Tel-Aviv University: Ramot. (Hebrew)

[3] Chan, K. W., & Elliott, R. G. (2004). Relational analysis of personal epistemology and conceptions about teaching and learning. *Teaching and Teacher Education, 20*, 817-831.

[4] Fives, H., & Buehl, M. M. (2016). Teachers' beliefs, in the context of policy reform. *Behavioral and Brain Sciences, 3*, 114 - 121.

[5] Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)* (2nd ed.). Thousand Oaks: Sage.

[6] Israeli Ministry of Education. (2015). Science and technology curriculum in primary and secondary schools. Retrieved on 15 August, 2015 from: http://cms.education.gov.il/EducationCMS/Units/Tochniyot_Limudim/science_tech/ (Hebrew)

[7] Watt, H. M. G. (2005). Attitudes to the use of alternative assessment methods in mathematics: a study with secondary mathematics teachers in Sydney, Australia. *Educational Studies in Mathematics, 58*, 21–44.

★★★