Title	Relationships among Singaporean secondary teachers' conceptions of assessment and school and policy contextual factors
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School and Policy Contextual Factors

[Authors blinded]

Abstract

This study examines teachers' conceptions of assessment and related contextual factors at the classroom, school, and national level. A representative survey of Singaporean secondary school teachers resulted in a final sample consisting of 229 teachers from 9 secondary schools. Findings on that teachers endorse views of assessment for school accountability, student accountability, and student improvement, but little endorsement of assessment as irrelevance. Teachers report feeling capable and qualified to use assessments, but concerned about how much they are trusted as assessors at school and national levels. Follow-up latent class analysis identified groups of teachers based on their responses to the irrelevance of assessment; teachers who found assessment irrelevant were present across all schools and subjects, but showed lower sense of preparation for assessment, school level support, and importance of academic success in society.

Keywords: conceptions of assessment; contextual factors; educational assessment; latent class analysis; teacher beliefs and views

Understanding Teachers' Conceptions of Assessment and Contextual Factors: Survey

Results from Singapore

The global transition toward knowledge- and innovation-driven economies is encouraging many countries to pursue educational reforms with explicit goals of supporting students' higher-order thinking and what are often called 21st century skills, such as technological literacy, innovative thinking, and collaboration (Dede, 2010). To achieve these goals requires assessment policies and classroom practices that support such reformed visions of teaching (Reeves, 2010). Because teachers play an essential role in the achievement of systemic educational goals (Smith & O'Day, 1990), it is important to understand how they view assessment and the relationship of these views to their assessment knowledge and use. However, relatively little is understood about the relationships between conceptions of assessment and contextual influences on teachers' views about assessment, particularly from a systematic perspective. In this study, we address this gap in the literature using data from a survey of Singaporean secondary school teachers' conceptions of assessment and various contextual factors that may influence them.

Contextual factors at the individual, school, and societal level are conjectured to affect not only teachers' assessment practices in the classroom, as well as relationships among teachers' assessment practice, views and beliefs, and knowledge (Fulmer, Lee, & Tan, 2015). Examining these factors provides a lens through which to study not only individual differences but also the role of school and societal influences. In this study we focus on teachers' views and beliefs regarding assessment, here called *conceptions of assessment* (COAs) following Brown's (2004) usage. COAs have been demonstrated to influence classroom assessment practices (James &

Pedder, 2006; Tan, 2013). As previous work has shown, teachers have a variety of views about assessment, for example that assessment serves purposes of accountability, of improvement (Brown, Kennedy, Fok, Chan, & Yu, 2009), or that it is entirely irrelevant (Brown, 2004). However, little is currently known about the contextual influences on COAs, and in particular within a system with high accountability pressure. By studying these influences, this study has potential to inform future work to develop and test interventions at the individual, school, or system level to support teachers' COAs that account for differences in contextual factors.

An international trend toward educational accountability has increased the importance of assessment at the societal, school, and classroom levels in many countries. Singapore's meritocratic system relies on an educational assessment regime that has high stakes for individual students, thus giving assessment a significant role in student, teacher, and school accountability. This system of assessments and rewards has resulted in notable successes on international comparisons such as PISA (OECD, 2009) and TIMSS.

In contrast to this tradition of high-stakes assessment and related successes, the Singapore Ministry of Education (MOE) has adopted policies that provide new directions for teachers' assessment practices and COAs. The recent efforts have promoted assessment at the school and classroom level that involve a variety of alternative assessment ideas. At the primary level, the goal was more holistic assessment (MOE, 2010b) that would emphasize qualitative feedback and using a variety of assessment approaches. At the secondary level, the goal was more balanced assessment (Leong & Tan, 2014) that would incorporate both formative and summative assessment approaches, and include opportunities for authentic assessment and its integration with experiential learning opportunities (MOE, 2010c). The goal of the policies is to encourage teachers' use of classroom assessments that go beyond conventional assessment of learning

approaches to encourage assessment *for learning* and to stimulate development of students' 21st Century skills (MOE, 2010a). Despite the policy efforts for assessment for learning enacted over the preceding decade, there remain significant concerns about whether Singaporean teachers' present COAs enable them to enact such assessment policies (Koh & Luke, 2009), which may be due to their own individual experiences (Tan, 2013) and reflect longstanding social values about performance and assessment (Kennedy, 2007) or about meritocratic social goals (Gopinathan, 2012). Thus, the Singapore context provides a rich setting in which to study teachers' COAs and the influences of contextual factors such as the individual, the school, and national policies. In the following section, we review background to the study, including the conceptual framework and related literature. This leads to our research questions, after which we describe the methods, before sharing our findings and interpretations.

Background to the Study

We draw on the conceptual framework proposed by Fulmer, Lee, & Tan (2015) in a review of the contextual influences on teachers' assessment practices that adopted Kozma's (2003) approach to identified influences at three levels (see Figure 1): *micro*, the teacher or classroom level; *meso*, the school level; and *macro*, the cultural or national level. The micro level encompasses influences from the individual teacher and her or his classroom, including COAs, values, and knowledge. The meso level encompasses influences within the school, such as its leadership, facilities, resources, and culture. The macro level encompasses broad influences for the state, nation, or society, such as educational standards, educational policies and resources, and cultural values and expectations. The adoption of this framework helps to focus the present study on the connection between the teachers' COAs and other micro-level factors and with meso- and macro-level factors.

Insert Figure 1 about here.

The growing body of research on the nature and forms of teachers' COAs has explored two distinct conceptualizations of COAs and associated approaches to its study. The first is Brown's work (e.g., 2004, 2006) on COAs, focusing on the underlying ideas about the roles and purposes of assessment at an overarching level. This line of research identified four patterns of COA: assessment for the purposes of *improvement*, or of *student accountability* or *school accountability*, or that assessment was *irrelevant*. These are not mutually exclusive, as any individual teacher could endorse more than one of these dimensions at one time. The second conceptualization is that of James and Pedder (2006), focusing on espoused values for alternative assessment within the classroom. This line of research identified three forms of values: making learning explicit, promoting learning autonomy, and performance orientation. Whereas values-focused COAs were completely classroom-specific (James & Pedder, 2006), the roles and purposes focus included the classroom as well as assessment purposes in a more general sense (e.g., Brown, 2006).

More recently, Tan's (2013) phenomenographic study of primary school teachers' COAs for alternative assessment demonstrated three conceptions of alternative assessment: conservative, pragmatic, and progressive. Teachers holding conservative COAs were interested in preserving the status quo, and would use alternative assessments only as a supplement for existing practice. Teachers holding pragmatic COAs were focused on effectiveness of various assessment approaches to achieve learning outcomes, but confined their thinking only to ways to complement their existing approaches with alternative assessment. Teachers holding progressive COAs saw alternative assessment not only as an effective classroom practice within the subject area, but also as conveying a vision that required revamping their practice toward sustainable,

long-term approach to assessment. By contrast, Leong's (2014) application of the Q-method identified four patterns in how teachers viewed assessment, its purposes, and its application. First was agentic, in which assessment is used to serve students' learning process regardless of formal tests. Second was dilemmatic, held by teachers who adopt more conventional assessment approaches despite their desires or hopes for alternative approaches. In empirical, younger teachers with more recent training on assessment emphasized the role of research and its implications for using alternative assessment. Lastly, the evolving viewpoint was held by teachers who rarely used formal assessment due to the nature of their content areas.

Across the varied conceptualizations, research continues to establish connections of COAs with teachers' practices and with other contextual factors that affect teachers. One major theme across studies is how COAs help uncover tensions for teachers' perceived roles as facilitators and versus as evaluators. For example, findings in the Netherlands showed the competing roles of secondary teachers for making judgments of performance while catering to individual student needs (Segers & Tillema, 2011). Similarly, James and Pedder's (2006) survey explored gaps among in-service teachers in the promotion of learning autonomy versus performance monitoring. This has been corroborated with subsequent work (e.g., Winterbottom, Brindley, Taber, Fisher, Finney, & Riga, 2008; Winterbottom, Taber, Brindley, Fisher, Finney, & Riga, 2008) among pre-service teachers.

As proposed by the conceptual framework of Fulmer, Lee, & Tan (2015), the role of COAs and the tensions in teachers' role in the classroom are also likely affected by other contextual factors in the school or societal level. For an example at the school level, Davis and Neitzel (2011) found that teachers' COAs are influenced in subtle ways by the referent and audience for assessment: emphasizing accountability when discussing with school colleagues,

while emphasizing improvement when talking with a class or with individual students. The role of contextual factors also comes into play in Hawe's (2002) findings on the "intuitive" versus "technocrat" roles of teachers and the school-level influence of the institution's prescribed tools and macro-level influence of standards. The macro-level influence of national instructional reform efforts is apparent in a study of the discrepancies among elementary mathematics teachers' views and their reported practices (Adams & Hsu, 1998), and the high discrepancy between the perceived importance and actual practice of practices promoted in national reforms, such as writing-to-learn. Similarly, Remesal's (2007) study of primary and secondary mathematics teachers showed that secondary teachers held more of an accountability view rather than holding pedagogical views of assessment—and that this was due to the social roles of regulation and social control that assessment plays especially for the secondary level. Indeed, this parallel role of a social level was also supported by a multi-national survey of Spanish language teachers (Remesal & Brown, 2015), which supported a bifactor model involving both a set of societal-level factors (i.e., Formative Regulation and Societal Control), and a set of assessment-focus factors (i.e., teaching, learning, certifying, or accountability).

Despite the breadth of existing literature, there remain gaps in our understanding of the different forms of contextual factors that relate to COAs. Thus, this study's purpose is to understand Singaporean secondary teachers' COAs and possible connections with contextual factors. We posed two research questions: (1) What are Singaporean secondary teachers' conceptions of assessment? (2) How are these conceptions related to contextual factors? We addressed these questions through a representative survey of Singaporean secondary school teachers. We further focused on latent class analysis of teachers based on their endorsement of assessment being 'irrelevant.' The purpose of latent class analysis is to uncover possible groups

of teachers that are not associated with existing demographic data (e.g., years of experience, subject area, etc.), but rather are based on patterns in their responses to items. As we describe further in the Results section, we focus on the sense of assessment as 'irrelevant' because this is the only COA for which teachers seem to disagree and it is unrelated to the other COA factors of improvement, student accountability, and school accountability—thus indicating a need for more in-depth attention.

Methods

Data Sources and Procedures

Data for the study come from a nationally representative sample of Singaporean secondary school teachers. The sample was drawn in two stages: first, schools were sampled at random and contacted, and then teachers within agreeing schools were sampled. The teacher-level sampling process depended on school policies—in some cases the school provided a complete sample frame from which the researchers drew teachers at random; in other cases the school selected at random from their records and provided a sample to the researchers. Replacement was used at both school and teacher level to increase representation and response rates. Nine sampled schools agreed to participate. These 9 schools, although a small sample, were relatively well representative of the Singaporean secondary schools. All regions of Singapore were represented (e.g., North, East), and all types of school were represented with 7 government or government-aided schools (compared to 93% of all Singaporean secondary schools) and 2 independent schools (compared to 7% of all Singaporean secondary schools; cf. MOE, 2012). From within these 9 schools, the final data set consisted of 229 completed teacher responses. Except of one smaller specialized school, on average there were 27 teachers who responded per school.

Each responding teacher completed three questionnaires using an online survey system. The first questionnaire consisted of items from Brown's (2006) study of teachers' COAs. The instrument consisted of 27 items that address a set of views about assessment purposes and value, each scored on a 6-point Likert-type scale. The items can be sorted into four subscales: student accountability, school accountability, improvement, and irrelevant. For the COA instrument, the subscales show good internal consistency, with Cronbach's alpha values of .82 for student accountability, .64 for school accountability, .86 for improvement, and .85 for irrelevant.

The second questionnaire addressed contextual factors. It consisted of 29 items developed by the project that address various micro-, meso-, and macro-level factors that can affect teachers' views and practices (Authors, 2013) using a 4-point Likert-type scale. The contextual factors items are not designed to be analyzed as subscales, so Cronbach's alpha is not calculated and the responses are considered on an item-by-item basis. The third questionnaire consisted of demographic items, including total years of teaching experience, years in their current school, subject area (e.g., mathematics, humanities, sciences), and so on. Table 1 provides demographic information on the sampled teachers, showing a broad range of experience (whether in years or in current/previous leadership) and varied subject areas.

Insert Table 1 about here.

Data Analyses

We proceeded with two forms of analysis on the COA responses. First, we conducted ANOVA and regression analyses on the proposed subscales to compare the teachers' views on the different measures (e.g., assessment as *school accountability*) with other outcome variables

(e.g., assessment as *student improvement*) and to test for any relationship with demographic data, such as years of teaching experience. We further computed correlations among the various contextual factors items across scales to identify relationships among these factors across levels.

Second, we conducted a latent class analysis (LCA) on the teachers' responses to the items on the *Irrelevant* subscale items. This is because of findings—described below in the Results section—that show a markedly different pattern for this subscale than in some previous research. Thus we pursued the LCA to explore further the potential differences in the *irrelevant* subscale responses. LCA is an approach to uncover patterns in responses that may indicate similarities in response types, but that are not associated with pre-existing demographic data. We ran a series of LCA models to identify possible groups of teachers based on their questionnaire responses. All analyses were run in the R statistical software environment (Ihaka & Gentleman, 1996) using the poLCA package (Linzer & Lewis, 2011). To avoid confusion with the term *class* to refer to a group of students, we will call any identified groups of teachers a *latent group* for the remainder of the paper. Because we did not presume any set number of groups within the data, we attempted statistical models for a sequence of groups to detect whichever are best fitting. Between 1 and 6 groups were attempted to identify the best-fitting model. For each number of groups that was modeled, the poLCA package runs a repeated analysis to identify the most stable estimate. Then, we compared the fit for the different models using typical model fit statistics. In this case, we select based on BIC (Bayesian Information Criterion) and AICc (Akaike's Information Criterion with a correction for finite sample size). For both BIC and AICc statistics, lower values indicate better fit (Burnham & Anderson, 2004). If an acceptable model is identified, each person is assigned to the latent group that matches the model's prediction. We

then compare these latent groups with ANOVA to examine differences among these latent groups.

Results

Teachers' Conceptions of Assessment

We first examined the teachers' responses on the COA instrument to understand their views of assessment. As shown in the descriptive statistics in Table 2, teachers indicated moderate agreement with the view that assessment serves purposes of student accountability, school accountability, and improvement. These three variables are also positively correlated, consistent with previous research. By contrast, the teachers indicated slight disagreement with the notion that assessment is irrelevant. We found no significant relationship, neither positive nor negative, between teachers' views of assessment as irrelevant and being about student accountability.

Insert Table 2 about here.

Our subsequent analyses tested for differences within the survey responses to identify any response bias and to test for differences among demographic sub-groups. For response time, no significant relationship was found with the time required for a response to the survey (in days; r values ranged from -.03 to .11, p > .05). Results showed no statistically significant differences between teachers by school (p > .05 for all ANOVA) or by subject area (p > .05 for all ANOVA), and no significant correlation with years of teaching experience for any of the COA scales (r values ranged from -.003 to .054, p > .05). This indicates that the findings would likely be consistent for Singaporean secondary teachers across schools, subject areas, and experience.

Latent Class Analysis on COAs

Previous work on COAs in Western settings (e.g., in Australia and New Zealand; Brown, 2006) has shown that the Irrelevant factor is positively related to other COA factors. On the other hand, previous research in Asian settings with a high focus on examinations, such as Hong Kong and China, show much lower endorsement of the notion of assessment as irrelevant (Brown, Hui, Yu, & Kennedy, 2011; Brown et al., 2009). Our findings in Singapore are thus somewhat different from previous work both in Western settings and Asian settings. The lack of a relationship of *Irrelevant* with the other COA factors indicated that some teachers could endorse ideas of assessment serving purposes of accountability or improvement, but may vary widely on their endorsement of assessment being irrelevant. We interpreted this to mean that teachers' views of assessment as irrelevant may reveal something about the teachers that is not uncovered through the other COA findings or through demographic information alone—that teachers who endorse assessment as irrelevant may differ in unexpected ways from teachers who do not. Thus, we pursued the Irrelevant COA items further with a latent class analysis (LCA).

As described in the Methods section, we tested models that allowed for between 1 and 6 latent groups, and compared the models using BIC and AICc to identify the best-fitting model. The solution with two latent groups was selected as the best-fitting model (BIC = 5597.54; AICc = 5407.29). Each teacher was assigned to one of these two latent groups, A or B, as predicted by the LCA model. Descriptive statistics for the A and B teachers are shown in Table 3. We then compared these latent groups. As shown in Table 3, group B teachers, who agree much more strongly with assessment being irrelevant than the group A teachers do (p < .05), make up about 40% of the sample. Group B teachers have statistically lower agreement with the view that

assessment is for student accountability (p < .05) or for student improvement (p < .05). However, there is no significant difference in the groups' views on assessment as *school* accountability.

Insert Table 3 about here.

Importantly, the teachers from latent groups A and B are not necessarily different on any of the demographic data. For example, a chi-square test of association showed there is no significant relationship ($\chi^2 = 5.721$, df $= 7$, p $= .573$) between membership in group A or B with subject (e.g., mathematics, humanities, etc.). Similarly, no statistically significant differences were found between the A and B group teachers for total years of experience. This underscores the importance of and the potential for latent group analyses to uncover differences that may otherwise go unnoticed when comparing teachers by conventional demographic data.

Contextual Factors

Regarding teachers' perceptions and expectations about contextual factors, recall that these items were not constructed to form subscales but to address various influences at the micro, meso, or macro levels. A full list of the items and the results are given in the Appendix. We observed that the items have overall high degree of agreement. Given this overall tendency to agree, we call attention to specific items with much higher or much lower agreement (Table 4). We interpret these results to indicate that teachers feel personally competent (items 1 and 6) and supported by the school (Item 15). Yet the teachers also felt a lack of trust on their assessment practices within the school (Item 17), which is consistent with the apparent concern for the ways they are judged on assessment results (Item 11) and how this could be affected by adopting new assessment strategies (Item 27). Furthermore, there is an interesting discrepancy between

teachers' self-confidence (Item 1) and their desire for more training on assessment at the system level (items 22, 24, and 25).

Insert Table 4 about here.

Moving beyond average responses, we also examined item correlations across the micro, meso, and macro levels. Full tables for these correlations are available in the appendix along with the complete item texts. The great majority of the statistically significant correlations are positive. For example, the highest correlation among the micro and meso items is between Items 17 ("Teachers need to be trusted for their centralized school-based marking") and 5 ("I must have enough content knowledge to help me during the assessment moderation process"), $r = 0.278$, $p < .01$. Item 17 is also correlated with Item 9 ("I understand the complexity [e.g. transparency, confidentiality] involved in assessment issues"), $r = .251$, $p < .01$. That is, teachers who desired more trust in their school-based assessment decisions also recognized the importance of having content knowledge and of understanding some of the complex issues for creating and administering assessments.

At the intersection of micro and macro level views, the greatest correlation is between Item 2 ("I need more knowledge in order to design good assessment for my class") and Item 29 ("People with assessment knowledge must be allowed to help lead at schools"), $r = .358$, $p < .01$, followed closely by the correlation between Item 2 and Item 24 ("Teachers need knowledge on how to make assessment consistent"), $r = .355$, $p < .01$. Item 29 ("People with assessment knowledge must be allowed to help lead at schools") is also correlated with Item 5 ("I must have enough content knowledge to help me during the assessment moderation process"), $r = .330$, p

< .01. Furthermore, Item 5 is correlated with Item 20 ("Policy must support innovative

assessment efforts at school…"), $r = .326$, $p < .01$. We interpret this pattern of results to indicate

that teachers who want more assessment knowledge desire more consistent and visible policy

and leadership for classroom assessment at the national level.

Looking at how the meso level factors are related to the macro factors, we see an

interesting pattern of correlations with Item 13 ("I need clear communicated goals from school

leaders with regards to assessment issues"). It is correlated with Item 24 ("Teachers need

knowledge on how to make assessment consistent"), $r = .358$, $p < .01$, Item 25 ("Teachers need

knowledge on how to make assessment valid"), $r = .251$, $p < .01$, and Item 29 ("People with

assessment knowledge must be allowed to help lead at schools"), $r = .251$, $p < .01$. We interpret

these relationships to emphasize that teachers who feel a lack of clear direction on assessment

within the school also see a system-wide need for more teacher education on assessment and the

importance of system-wide support for school leaders with assessment knowledge and

experience.

As we noted above, most statistically significant correlations were positive, except for

three inter-item correlations that were statistically significantly negative--all of them between

micro level and meso level items. Item 2 ("I need more knowledge in order to design good

assessment for my class") was significantly correlated with Item 10 ("My colleagues are

supportive of one another as we explore new assessment"), $r = -.139$, $p < .05$. Item 3 ("I need

support to craft appropriate rubrics") was significantly correlated with Item 10, as well, $r = -.158$,

$p < .05$. Finally, Item 3 ("I need support to craft appropriate rubrics") was also significantly

correlated with Item 14 ("My school culture is supportive of teachers who have good assessment

knowledge"), $r = -.168$, $p < .05$. We interpret these negative relationships to mean that teachers

who felt they needed more knowledge of assessment and rubrics did not feel well supported by
their schools, and vice versa—that feeling more supported by the school is associated with
higher sense of competence and understanding.

As a last step we compared the latent groups A and B on the responses to the contextual
factors items. Six items had statistically significant differences (Table 5). At the micro level,
group B teachers—who feel assessment is irrelevant—also report lower sense of competence in
designing assessments, and higher need for support in developing rubrics. At the meso level, the
group B teachers also feel that their school offers less support for assessment knowledge. Note
that these teachers are not confined to any particular school, because both A and B teachers are
present in all schools and subject areas. So, within each school there are teachers who feel less
supported by the school when it comes to assessment, feel less knowledgeable about assessment,
and need more help with their assessment rubrics—and these teachers who need such support are
more likely to view assessment as irrelevant to them or their class.

Insert Table 5 about here.

Discussion

This study sought to understand the relationships among COAs and contextual factors for
Singaporean secondary teachers. On one hand, the findings are consistent with some prior
research in showing that teachers supported the notions of assessment for student accountability,
school accountability, and student improvement. On the other hand, the findings differ from
other existing research on COAs in Western settings due to the lack of support for the notion of
assessment as irrelevant. But the findings are not purely a replication results seen in other high-

stakes testing systems, such as Hong Kong (Brown et al., 2009; Berry, 2011), which highlighted the high incidence of examination preparation practices to help students and to meet school goals. We see this demonstrating how Singapore's education system and its teachers hold attributes at once like other Asian settings and like Western settings. This also shows that attributing a system as either fully "Asian" or "Western" is imprecise and unhelpful for understanding each system's context for assessment.

Indeed, Singapore is like Hong Kong and China in a strong tradition of centralized assessments: Singapore teachers are embedded within a high-stakes examination environment that relies on norm-referenced assessment results for placement and advancement within the society's meritocratic system, which has repercussions for students, schools, and the teachers themselves (Leong & Tan, 2014). But Singapore also has a British colonial history that continues to influence its current school system, has widely adopted English in public and home life, and has seen a raft of recent policy initiatives to produce alternative schooling pathways and to defuse tension around assessment. This may explain, for example, how the mean response on the Irrelevant COA is neither as high as in Western settings (Brown, 2006) nor as low as in other Asian settings (Brown et al., 2011). At the same time, Singapore is moving like many East Asian countries to broaden the notion of assessment, to open alternative educational pathways for students, and to develop its teachers' assessment literacy (Ratnam-Lim & Tan, 2015). This underscores a theoretical and methodological challenge when making international comparisons of teachers' assessment views and practices: while there are potential patterns to uncover, there are limitations to how distinctly such a pattern may hold across contexts. Teachers may have broad exposure not only to their own policy and cultural context but can develop global awareness and connections. This creates tensions for teachers and can complicate how we

theorize about and study the influences on teachers by their school and national context. So, the tensions between conceptions of assessment and the contextual factors have consequence not only in Singapore but throughout the region.

The discrepancies we observed show that many teachers feel personally knowledgeable and capable to carry out assessments in the classroom, but they feel the need for a system-level investment in professional development. They also desire more trust and greater acceptance from their school- and national-level leaders as they undertake innovative assessment approaches. This provides some insight into the challenges on Singaporean teachers within a changing assessment system as it shows a tension between the role of a teacher in setting classroom and school assessments, while worrying about questions from parents, key personnel, and others. This underscores the pressures on teachers during the changes within the system as examination-focused instruction is being discouraged and more alternative, authentic, and holistic assessment is encouraged.

Further analysis of teachers' opinions on assessment's irrelevance using latent class analysis showed a subset of teachers who *do* endorse the irrelevance view. Teachers who subscribe to the irrelevant view of assessment may be relatively less common in the Singapore context, as in this study they make up 40% of our sample. We believe this observed proportion is reasonable for the context, given the highly visible and high-stakes purposes of assessment for the system and for individual students and their teachers. Even so, these teachers provide us insight into the role of individual, school, and system-level contextual factors. These teachers who endorse the view of assessment as irrelevant differ in that they feel less competent as an assessor, feel less support from their schools for engaging assessment, and disagree with the emphasis on academic success in society.

One of the valuable insights of this result is how this subset of teachers does not quite fit previous patterns. For example, there is not necessarily a values-practice gap (cf. James & Pedder, 2006). Neither does the pattern match recent findings in Singapore by Tan (2013) whose work identified conservative, pragmatic, and progressive conceptions of assessment among teachers. Rather, the assessment-irrelevant teachers in our sample may be *resistive* to the societal pressure for academic achievement, or could be *dissatisfied* with their in-school support for assessment, and report feeling personally less competent for assessment. Given the nature of this survey study, further work will be needed to identify more explicitly whether it is more appropriate to think of assessment irrelevance views as indicating resistance, dissatisfaction, self-doubt, or other beliefs.

Our latent class analysis yields another valuable insight: teachers who hold assessment-irrelevant views are present across all subjects and schools. Teachers who may be resistive or dissatisfied, and therefore view assessment as irrelevant, are not distinguishable using conventional demographic variables such as teaching experience, school, or subject. Furthermore, as demonstrated by the observed differences within schools, these findings highlight the potential impact of variation within schools on teachers' sense of school-level supports and influences. Even if a questionnaire yielded a school-wide average showing positive sense of support, there would still be a substantial group of teachers who may feel differently. This suggests to us that teachers in the same school can experience a very different school environment. This underscores the potential for interactions across the micro-level, meso-level, and macro-level influences that have been proposed by Fulmer, Lee, & Tan (2015). We also see important consistency between this finding and the work by Remesal and Brown (2015), in that it

highlights not only that there are individual-level variations in conceptions of assessment, but that these are also affected by broader societal-level influences.

Limitations

The results presented here are based on a representative survey of Singaporean secondary teachers. Though the study's two-stage sampling process provides a fairly representative sample of teachers, the sample size is somewhat small. More advanced analyses of complex relationship among contextual factors, such as could be conducted with structural equation modeling, cannot be conducted. A larger scale survey would be able to examine these relationships with more sophisticated analyses. Our study was also purely a survey, so we do not have richer qualitative data from teachers about their views and beliefs, *per se*, but rather are interpreted from their endorsement of questionnaire statements. One possibility for future work that can address this issue is to learn from Leong's (2014) application of the Q method to look at patterns in teachers' ranking of different assessment views and practices – to identify patterns of preference and to uncover through the sorting and subsequent interviews how teachers interpret these ideas. Furthermore, because we do not have a measure of teachers' assessment literacy or knowledge, we cannot say that teachers who report feeling less competent for assessment are actually less knowledgeable, or if they are in fact more self-critical. Further work to examine the role of contextual factors and incorporating other measures may be warranted as discussed below.

Implications for Practice and Future Research

At the nexus of policy and practice, our findings reveal that teachers feel they need to be more trusted and supported in their development and judgment of assessments. While feeling personally competent, they call for more assessment-focused training and support at school and the national levels. One interpretation is that the teachers lack confidence and self-efficacy for

describing their assessment decisions for new assessment directions to critical stakeholders. If

we accept this interpretation, then a potential resolution is to provide further support for the

teachers' understanding of fundamental ideas within assessment, such as validity and reliability,

and how to develop and implement alternative assessments in valid and reliable ways. This

would give them confidence and self-efficacy to communicate their assessment processes and

decisions with stakeholders. However, we cannot say with certainty that assessment knowledge

is sufficient, because there may be attitudinal and dispositional influences on the teachers that go

above and beyond their assessment knowledge. For example, Willis, Adie, and Klenowski (2013)

argued that teachers' assessment literacy needs to be understood as "an ethical, social, dynamic

and layered practice" (p. 252) that should be negotiated rather than be passively received.

Research on how assessment literacy is negotiated is obviously complex and contested in itself,

and it is important to ensure that teachers' voices and views of their assessment literacy are also

heard and supported. A valuable and viable starting point would be to study how teachers

experience and perceive their assessment literacy within the teaching context itself.

Thus, we recommend subsequent studies to gauge teachers' assessment literacy, self-

efficacy, confidence, and the disposition toward implementing novel assessments as proposed by

reformed assessment policies. This follow-up study would require larger sample sizes to allow

analyses of the complex relationships among these factors. An alternative direction would be to

engage experimental or quasi-experimental studies to see if assessment professional development

significantly affects the teachers' COAs or their endorsement of contextual factors.

A second interpretation for our findings is that teachers are receiving competing

messages about what assessment should be and how they should engage in it. For example, from

the standpoint of national examinations and the high-stakes outcomes for students and schools,

teachers may feel pressured to follow their experience and focus on achieving student results. This may conflict with the commentary and rhetoric pushing for alternative assessments, insofar as such alternative assessments are not part of the high-stakes examination system and may have little apparent value for the students' immediate advancement. There is great potential for future qualitative studies of teachers' interpretation of competing policy and curriculum ideas at the school and national level, how this is influenced by their training and their school experiences, and the ways in which they draw on these when making assessment decisions.

A third direction that complements the previous recommendations is for future research to explore the complex interactions between individual and school-level factors. This would build on our findings that assessment-irrelevant teachers are present in all schools and subject areas. Greater understanding is needed about the variability within schools in how teachers experience assessment, and how such differences about school experiences are related to the teachers' own understanding of assessment and their beliefs about the appropriate paths to support their students.

A fourth direction, inspired by our application of latent class analysis (LCA), is to conduct further COA research with an eye for latent groups who may differ on patterns of item response but not on other demographic information. That could mean, for example, reanalysis of previous COA research in Western and Asian settings using LCA to see if there are similarities or differences with the Singapore findings on endorsement of assessment as irrelevant, or identify other unexpected differences on the teachers' COAs.

In sum, our study's findings provide a rich view of the conceptions of assessments of Singaporean secondary teachers, and their endorsement of various contextual factors on their assessment views and practices. The results provide a snapshot of a system in which teachers

experience tension between the demands of conventional high-stakes examinations and the impetus for alternative assessments. We believe these findings are informative not only for the Singapore context, but also for other school systems that currently have high-stakes examination systems or that are in the process of assessment change.

References

Adams, T. L., & Hsu, J. W. Y. (1998). Classroom assessment: Teachers' conceptions and practices in mathematics. *School Science and Mathematics*, *98*(4), 174-180.

Berry, R. (2011). Assessment trends in Hong Kong: seeking to establish formative assessment in an examination culture. *Assessment in Education, 18*(2), 199 - 121.

Brown, G. T. L. (2004). Teachers' conceptions of assessment: Implications for policy and professional development. *Assessment in Education: Principles, Policy & Practice, 11*(3), 301-318. doi: 10.1080/0969594042000304609

Brown, G. T. L. (2006). Teachers' Conceptions of Assessment: Validation of an abridged version. *Psychological Reports, 99*, 166-170. doi: 10.2466/pr0.99.1.166-170

Brown, G. T. L., Hui, S. K. F., Yu, F. W. M, & Kennedy, K. J. (2011). Teachers' conceptions of assessment in Chinese contexts: A tripartite model of accountability, improvement, and irrelevance. *International Journal of Educational Research*, *50*, 307-320. doi:10.1016/j.ijer.2011.10.003

Brown, G. T. L., Kennedy, K. J., Fok, P., Chan, J. K. S., & Yu, W. M. (2009). Assessment for student improvement: Understanding Hong Kong teachers' conceptions and practices of assessment. *Assessment in Education: Principles, Policy & Practice, 16(3)*, 347-363. doi:10.1080/09695940903319737

Burnham, K. P., & Anderson, D. R. (2004). Multimodel inference: Understanding AIC and BIC in model selection. *Sociological Methods & Research*, *33*, 261–304. doi: 10.1177/0049124104268644

Davis, D. S., & Neitzel, C. (2011). A self-regulated learning perspective on middle grades classroom assessment. *The Journal of Educational Research*, *104*(3), 202-215.

Dede, C. (2010). Comparing frameworks for 21st century skills. In J. Bellanca & R. Brandt (Eds), *21st Century Skills* (pp. 51-76). Bloomington, IN: Solution Tree Press.

Fulmer, G. W., Lee, C. H. I., & Tan, K. H. K. (2015). Multi-level model of contextual factors and teachers' assessment practices: An integrative review of research. *Assessment in Education: Principles, Policy & Practice*. 22, 475-494 doi: 10.1080/0969594X.2015.1017445

Gopinathan, S. (2012). Fourth Way in action? The evolution of Singapore's education system. *Educational Research for Policy and Practice, 11(1*), 65-70.

Heng, S. K. (2014, May). *Assessment innovations for the 21st century*. Opening address at the 2014 International Association for Educational Assessment (IAEA) Conference, Singapore.

Hawe, E. (2002). Assessment in a pre-service teacher education programme: The rhetoric and the practice of standards-based assessment. *Asia-Pacific Journal of Teacher Education*, *30*(1), 93-106.

Ihaka, R., & Gentleman, R. (1996). R: a language for data analysis and graphics. *Journal of computational and graphical statistics*, *5*(3), 299-314.

James, M., & Pedder, D. (2006). Beyond method: Assessment and learning practices and values. *The Curriculum Journal, 17*, 109-138. doi: 10.1080/09585170600792712

Kennedy, K. J. (2007). *Barriers to innovative school practice: A socio-cultural framework for understanding assessment practices in Asia.* Paper presented at the Redesigning Pedagogy: Culture, Understanding and Practice Conference, Singapore.

Koh, K. H., & Luke, A. (2009). Authentic and conventional assessment in Singapore schools: An empirical study of teacher assignments and student work. *Assessment in Education: Principles, Policy & Practice, 16*, 291-318. doi:10.1080/09695940903319703

Kozma, R. B. (2003). ICT and educational change: A global phenomenon. In R. B. Kozma (Ed.), *Technology, innovation, and educational change: A global perspective* (pp. 1- 18). Eugene, OR, USA: International Society for Technology in Education.

Leong, W.S. (2014). Singaporean teachers' views of classroom assessment: Findings from using Q-Methodology. *Assessment Matters*, 6, 34-64.

Leong, W. S., & Tan, K. H. K. (2014). What (more) can, and should, assessment do for learning? Observations from 'successful learning context' in Singapore. *The Curriculum Journal, Online edition*.

Linzer, D. A., & Lewis, J. (2011). poLCA: An R package for polytomous variable latent class analysis. Journal of Statistical Software, 42(1-29).

Ministry of Education. (2010a). *Nurturing our young for the future: Competencies for the 21st Century*. Singapore: Author.

Ministry of Education. (2010b). Press Release. PERI Holistic Assessment Seminar 2010 — 16 Schools Share Holistic Assessment Practices and Resources. Retrieved October 23, 2014 from http://www.moe.gov.sg/media/press/2010/07/peri-holistic-assessment-seminar.php

Ministry of Education. (2010c). Report of the Secondary Education Review and Implementation (SERI) Committee. Retrieved May 12, 2017 from https://www.moe.gov.sg/media/press/files/2010/12/report-secondary-education-review-and-implementation-committee.pdf

Ministry of Education. (2012). *List of Secondary Schools by Planning Area*.

Organisation for Economic Cooperation and Development [OECD]. (2009). PISA 2009 Results. Paris: OECD Publishing.

Ratnam-Lim, C., & Tan, K. H. K. (2015). Large-scale implementation of formative assessment practices in an examination oriented culture. *Assessment in Education, 22*(1), 61 - 78.

Reeves, D. B. (2010). *Transforming professional development into student results*. Alexandria, VA: Association of Supervision and Curriculum Development.

Remesal, A. & Brown, G. (2015). Conceptions of assessment when the teaching context and learners population matter: compulsory school versus non-compulsory adult education contexts. *European Journal of Psychology of Education*, *30*(3), 331-347.

Remesal, A. (2007). Educational reform and primary and secondary teachers' conceptions of assessment: the Spanish instance. Building upon Black and Wiliam (2005). *The Curriculum Journal*, *18*(1), 27-38.

Segers, M., & Tillema, H. (2011). How do Dutch secondary teachers and students conceive the purpose of assessment?. *Studies in Educational Evaluation*, *37*(1), 49-54.

Smith, M. S., & O'Day, J. (1990). Systemic school reform. *Journal of Education Policy, 5*(5), 233-267. doi: 10.1080/02680939008549074

Tan, K. (2013). Variation in teachers' conceptions of alternative assessment in Singapore primary schools. *Educational Research for Policy & Practice, 12*, 21-41. doi:10.1007/s10671-012-9130-4

Willis, J., Adie, L. A., & Klenowski, V. (2013). Conceptualising teachers' assessment literacies in an era of curriculum and assessment reform. *Australian Educational Researcher, 40*, 241-256.

Winterbottom, M., Brindley, S., Taber, K. S., Fisher, L. G., Finney, J., & Riga, F. (2008).

Conceptions of assessment: Trainee teachers' practice and values. *The Curriculum

Journal, 19*(3), 193-213. doi:10.1080/09585170802357504

Winterbottom, M., Taber, K. S., Brindley, S., Fisher, L. G., Finney, J., & Riga, F. (2008).

Understanding differences in trainee teachers' values and practice in relation to

assessment. *Teacher Development, 12*(1), 15-35. doi:10.1080/13664530701827723