Title	Perceived teaching practice and its prediction of student engagement in Singapore
Author(s)	Wenshu Luo
Source	*Asia Pacific Education Review, 18*(4), 451-463
Published by	Springer

This is postprint (final draft post-refereeing) before publication. Please refer to the following authoritative source. The final publication is available at link.springer.com

https://link.springer.com/article/10.1007/s12564-017-9502-9?no-access=true

Luo, W. (2017). Perceived teaching practice and its prediction of student engagement in Singapore. *Asia Pacific Education Review, 18*, 451-463.

Perceived Teaching Practice and Its Prediction of Student Engagement in Singapore

This study examined teaching practice in Singapore mathematics classrooms and its prediction of student engagement. A large sample of Singapore Secondary 2 students first reported perceived teaching practice in their mathematics classrooms in Term 1 and their engagement in mathematics study in Term 2. Based on Rasch analysis of teaching practice, it was found that in general students perceived their mathematics teachers to be more learning-focused supportive than performance-focused controlling. Boys and low-achieving students from the normal stream perceived their teachers to be more performance-focused controlling. Hierarchical linear modeling found that at student level, students who perceived their teachers to be more performance-focused controlling reported higher classroom disruption, disorganization and metacognitive self-regulation, and students who perceived their teachers to be more learning-focused supportive reported higher classroom attention and metacognitive self-regulation. At class level, perceived performance-focused teacher control positively predicted students' disorganization. In addition, this study also found some cross-level interactions on classroom disruption. Theoretical and practical implications of the findings are discussed.

Keywords: Classroom goal emphasis, Teacher control, Teacher support, Student engagement

Introduction

Student engagement has attracted tremendous attention in educational research due to its important role in improving learning and reducing school dropout (e.g., Fredricks, Blumenfeld, & Paris, 2004; Park, 2005; Reeve & Tseng, 2011). Students' engagement reflects the quality of their participation in learning activities (Skinner, Kindermann, & Furrer, 2009). It is often viewed as manifestation of achievement motivation, which energizes engagement as internal forces (Boekaerts, 2016; Skinner et al., 2009). Researchers have generally agreed that engagement is a multi-dimensional construct, although there is lack of consistency about the number and nature of the dimensions (Boekaerts, 2016; Fredricks et al., 2016). The 3-dimension conceptualization of engagement by Fredricks et al. (2004) is one of the most prevalent frameworks. In this framework, engaged students are invested in learning behaviorally (presence of attention, effort and positive conduct, and absence of disruptive behaviors), emotionally (presence of positive achievement emotions and absence of negative emotions), and cognitively (use of cognitive and metacognitive strategies for deep understanding, rather than no use or use of surface-level strategies). Research has found that classroom contexts, such as achievement goal emphasis and teacher support, play an important role in shaping student motivation and engagement (for reviews, see Fredricks et al., 2004; Rolland, 2012).

However, education worldwide is now characterized by a growing culture of performativity, with an intense focus on output measurement and competitive rankings (Gorur, 2016). This promotes schools and teachers to focus on preparing students for examinations, rather than meeting learners' needs and preparing them to meet challenges in real life (Ball, 2003; Zhao, 2017). To address this issue, one important reform initiative in Singapore education is "Teach Less, Learn More" (TLLM) launched in 2005. As pointed out by Ng (2008), TLLM is a policy initiative to

address the concern that students are driven externally by an excessive focus on national examinations and may not be adequately engaged in learning. For example, drawing on data collected in 2010, a study on instructional practice in Singapore Secondary 3 English and mathematics classrooms reported substantial evidence of a performative orientation to instruction, shaped by national high-stakes assessments (e.g., Hogan et al., 2013). The critical question is how to teach less so that students can be more engaged and learn more. According to the Ministry of Education (MOE) of Singapore (2010), "It is about shifting the focus from 'quantity' to 'quality' in education. 'More quality' in terms of classroom interaction, opportunities for expression, the learning of life-long skills and the building of character through innovative and effective teaching approaches. 'Less quantity' in terms of rote-learning, repetitive tests, and following prescribed answers and set formulae." Therefore, one important change called for by this reform is that teachers should reduce performance-focused teaching, but apply more learning-focused teaching to enhance student engagement. The TLLM reform was first prototyped in some schools and expected to be scaled up to all schools by 2011. However, little research has examined the motivational aspect of classroom teaching in Singapore, especially in the TLLM reform context.

From a motivational perspective, this study aimed to investigate how Singapore secondary students perceive teaching practice in their mathematics classrooms and how perceived classroom practice predicts student engagement. This study focused on mathematics classrooms, because mathematics is often regarded as an important and difficult subject (e.g., Fredricks et al., 2016; Kaplan, Gheen, & Midgley, 2002). In addition, student perception of classroom environment was examined in this study because it has been found to be more important in predicting student motivation and engagement than the objective classroom environment (Church, Elliot, & Gable, 2001; Rolland, 2012).

Literature Review

Classroom goal emphasis and student engagement

Arising from achievement goal theory of motivation, it has been argued that classroom teaching practice can make certain achievement goals salient to students (Ames, 1992). Researchers have suggested that classroom practice promotes a mastery goal emphasis/structure when classroom tasks offer personal challenge, give students a sense of control, and tap students' interest; when students are given authority over their learning and provided opportunities to develop responsibility and independence; and when classroom evaluation focuses on progress and mastery of skills. In contrast, classroom practice promotes a performance goal emphasis/structure when ability differences are highlighted, such as through normative grading, giving special privileges or recognition to high achieving students, and emphasizing relative performance over the process of learning (Ames, 1992; Maehr & Midgley, 1996; Urdan & Schoenfelder, 2006).

Research has found that classroom goal emphasis plays an important role in student motivation and engagement. Although achievement goals researchers have distinguished approach and avoidance types of both mastery/learning and performance goals (Elliot & McGregor, 2001; Elliot, Murayama, & Pekrun, 2011), most research on classroom goal structures focused on approach goal emphases (for reviews, see Meece, Anderman, & Anderman, 2006; Rolland, 2012). In general, classroom mastery goal emphasis, rather than classroom performance goal emphasis, was associated with adaptive student outcomes (for reviews, see Meece et al., 2006; Rolland, 2012). Perceived classroom learning goal emphasis was found to be positively associated with student mastery goals, academic self-efficacy, subject interest, effort and persistence, use of cognitive and metacognitive strategies, and emotional engagement (Friedel, Cortina, Turner, & Midgley, 2007; Greene, Miller, Crowson, Duke, & Akey, 2004; Luo, Hogan, & Paris, 2011; Schiefele & Schaffner,

2015; Shim, Cho, & Wang, 2013; Wolters, 2004). However, the findings about classroom performance goal emphasis were less consistent, although most studies found that it was associated with maladaptive motivation and disengagement. For example, student perceived classroom performance goal emphasis was associated with more classroom disruptive behaviors (Kaplan et al., 2002), low persistency and high procrastination (Wolters, 2004), and low emotional engagement (Shim et al., 2013). However, student perceived performance goal emphasis in both classroom and school was also positively associated with use of cognitive and metacognitive strategies (Wang & Holcombe, 2010; Wolters, 2004).

Teacher support versus control and student engagement

Another important motivation theory that has been applied to classroom teaching is self-determination theory (SDT), which posits that classroom practice that fulfills students' basic motivational needs will optimize student engagement (Deci, Ryan, & Williams, 1996). According to SDT, teachers differ in their instructional style that generates different motivational climates in the classroom. Some teachers exercise more control, while others provide more motivational support. Teacher control means that teachers pay little attention to students' inner motivational needs and resources and they get students to adopt expected behaviors by relying on external rewards, consequences, pressures and controlling modes of communication (Deci et al., 1996). Teacher support means that teachers attend to and provide support to meet students' motivational needs. The present study focuses on two important types of teacher support emphasized in SDT: autonomy and structure support. Teachers who provide autonomy support build their instructional activities around students' interest, preferences, personal goals, choice making, sense of challenge, curiosity, and self-direction (Deci et al., 1996; Jang, Reeve, & Deci, 2010; Sierens, Vansteenkiste, Goossens, Soenens, & Dochy, 2009; Skinner & Belmont, 1993; Skinner, Furrer, Marchand, &

Kindermann, 2008). Teachers who provide students structure support give clear expectations for their learning outcomes and behaviors, offer scaffolding or guidance during learning to instigate and maintain effort, and provide constructive feedback to help students diagnose and build on their skills (Deci et al., 1996; Jang et al., 2010; Sierens et al., 2009; Skinner & Belmont, 1993; Skinner et al., 2008). Compared with teacher control, structure and autonomy support are regarded as student-centred teaching and they are often found to be highly correlated (e.g., Jang et al., 2010; Reeve & Jang, 2006; Sierens et al., 2009; Skinner & Belmont, 1993).

Research grounded in SDT has reported distinct roles of teacher support and teacher control in student motivation and engagement. Some studies examined teacher control only, while other studies focused on teacher support. For example, a study that focused on teacher controlling practice (Assor, Kaplan, Kanat-Maymon, & Roth, 2005) found that elementary students' perceptions of their teachers as directly controlling were positively associated with student report of negative emotions, extrinsic motivation and restricted engagement (e.g., only studying what is required to get a good grade) and negatively associated with teacher report of intensive engagement (e.g., persistence in doing assignments). A study on teacher support found that teacher's autonomy and structure support as perceived by late adolescents and student teachers were positively correlated with their cognitive strategy use and metacognitive self-regulation (Sierens et al., 2009). An observation study by Jang et al. (2010) reported that teacher autonomy and structure support rated by observers were positively related to high school students' behavioral engagement (e.g., attention and effort) as both rated by observers and self-reported by students.

More recently, researchers argue that it is important to include both teacher support and control in a study because the absence of teacher support would not necessarily mean the presence of teacher control (Haerens, Aelterman, Vansteenkiste, Soenens, & Petegem, 2015; Jang, Kim, &

Reeve, 2016). For example, low to modest negative correlations were reported between teacher autonomy support and control (Cheon & Reeve, 2015; Haerens et al., 2015). Studies including both teacher support and control found that after controlling for each other, the former was primarily associated with adaptive motivation and engagement, while the latter was primarily associated with maladaptive motivation and disengagement (Haerens et al., 2015; Jang et al., 2016)

The integration of two theoretical perspectives of classroom practice

Theories and empirical studies on classroom teaching practice suggest that both classroom goal emphasis and teacher support versus control grounded in SDT play an important role in motivating and engaging students in their learning (e.g., Ames, 1992; Deci et al., 1996; Jang et al., 2010; Meece et al., 2006). Researchers have pointed out considerable overlap between these two motivational perspectives of classroom practice, with both emphasizing the shift of teachers' roles from a lecturing, controlling expert towards a nurturing facilitator who provides appropriate support for students to learn in their own pace (Urdan & Schoenfelder, 2006). For example, performance-focused evaluation is regarded as an important way to exercise teacher control (Deci et al., 1996). Autonomy support and appropriately challenging tasks are also key ingredients for creating mastery classroom goal structure (Ames, 1992). The substantial overlap between these two theoretical perspectives has also been found in empirical research. High positive correlations (>.70) were reported between students' perceived classroom mastery-oriented evaluation and teacher support, including providing meaningful, relevant and interesting tasks, offering choice, and encouraging responsibility and self-regulation of learning (Greene et al., 2004). A series of four studies on classroom motivational environment reported significant convergence between students' perceived mastery goal structure and teacher support characterized by teacher academic

support, teacher emotional support, classroom mutual respect, and task-related interaction (Patrick, Kaplan, & Ryan, 2011).

Therefore, the present study attempts to integrate these two motivational perspectives of classroom teaching. When teachers emphasize relative performance in examinations, they may tend to teach in a controlling way, such as through performance evaluations, imposed performance goals, and performance competition in the classroom. In contrast, when teachers emphasize learning and improvement, they may tend to teach in a motivationally supportive way to enhance students' engagement, such as through selecting interesting and optimally challenging tasks and providing guidance and feedback to facilitate learning. Based on the integration of these two theoretical perspectives, the present study measured two broad categories of classroom teaching practice: performance-focused teacher control and learning-focused teacher support.

This study adds to the literature on classroom practice and student engagement in two ways. First, it investigated perceived classroom practice by integrating the two motivational perspectives: classroom goal emphasis and teacher support versus control grounded in SDT. Second, it examined perceived classroom practice and its role in student engagement from a motivational perspective in the context of the TLLM reform in Singapore. More specifically, this study aimed 1) to examine how Singapore students perceive teaching practice in their mathematics classrooms, and 2) to examine the role of perceived teaching practice in predicting students' engagement. It was expected that students would perceive their teachers to be more learning-focused supportive than performance-focused controlling in the TLLM reform context. Based on the research reviewed above on classroom goal emphasis and teacher support versus control, it was hypothesized that performance-focused teacher control would negatively predict student engagement, while learning-focused teacher support would positively predict student engagement.

Method

Participants and procedure

Participants in this study were 3363 Secondary 2 (Grade 8) students from 104 classes (16 schools) in Singapore. As part of a larger project, they took two waves of online survey in this study (in 2013). They first reported perceived teaching practice in their mathematics classrooms in the first school term (January - March), and then took measures of engagement in the second school term (April - June). This prospective design was used to address the issue related to self-report measures, that is, not only students' perceived classroom practice might affect their report of engagement level, their academic engagement might also filter their perception and report of classroom practice (Koskey, Karabenick, Woolley, Bonney, & Dever, 2010; Tapola & Niemivirta, 2008). In consideration of the dynamic nature of student engagement (Jang et al., 2016; Skinner et al., 2008), this study addressed this problem by asking students to report the two groups of variables separately at two time points.

Among the 104 classes in Wave 1, 59 classes (2001 students) were from the express stream and 45 classes (1362 students) from the normal stream (including normal academic and technical). Students from the express stream were higher achieving than students from the normal stream based on their achievement in Primary School Leaving Examinations. The participants (M_{age} = 13.77, SD = .49) included 1217 (36.2%) boys, and comprised 2267 Chinese (67.4%), 579 Malay (17.2%), 264 Indian (7.9%), and 253 others (7.5%). Among them, 2648 students from 102 classes (966 boys, 36.5%) took measures on student engagement in Wave 2. There was no significant difference between these respondents and those missing in Wave 2 in person measures on teaching practice obtained in Rasch analysis (see below).

Measures

Perceived teaching practice

This study measured 2 broad categories of perceived teaching practice in mathematics classrooms. The items were either adapted from validated instruments reported in the literature or developed based on theoretical descriptions of the variables. The items were phrased to be domain-specific (i.e., mathematics) and in the way that they were easy to understand for participants in the local context (based on a pilot study). To measure perceived performance-focused teacher control (8 items), this study adapted items on classroom performance goal emphasis (4 items) from the Patterns of Adaptive Learning Scales (PALS, Midgley et al., 2000) and items on teacher control (4 items) from Assor, Kaplan, Kanat-Maymon, and Roth (2005). To measure perceived learning-focused teacher support (18 items), this study adapted items on classroom learning goal emphasis (4 items) from the PALS (Midgley et al., 2000) and designed items on autonomy (9 items) and structure support (5 items) based on SDT and existing measures in the literature (Assor, Kaplan, & Roth, 2002; Deci et al., 1996; Jang et al., 2010; Reeve, Jang, Carrell, Jeon, & Barch, 2004; Tsai, Kunter, Ludtke, Trautwein, & Ryan, 2008). The items on autonomy support tapped teaching practice that cultivates sense of challenge and deep thinking, make learning interesting and relevant to students, and encourage self-regulated learning, and the items on structure support measured teaching practice that provides clear learning goals, criterion of good work, guidance during study, and formative feedback. The items are presented in Figure 1.

An exploratory factor analysis (EFA) using Proximal Axis Factoring extraction found that there were two factors, which explained 53.67% of the variance in all the 26 items. One factor was loaded by all the items assessing performance-focused teacher control and the other factor was loaded by all the items assessing learning-focused teacher support. After rotation using Oblimin with Kaiser Normalization method, factor loadings ranged from .52 to .82. Internal consistency

alpha was .83 and .95, respectively, for perceived performance-focused teacher control and perceived learning-focused teacher support.

Student engagement

This study measured behavioral (classroom attention and disruption) and metacognitive dimensions (metacognitive self-regulation and disorganization) of student engagement (Fredricks et al., 2004). Adapted from validated measures reported in the literature, the items on student engagement were phrased to be domain-specific (i.e., mathematics) and in the way that they were easy to understand for participants in the local context. Classroom attention referred to the extent to which that students pay attention to the ongoing activities in mathematics class, and classroom disruption referred to students' behaviors in mathematics class that annoy the teacher or disrupt class (Kaplan et al., 2002). The scale of classroom attention (3 items) was adapted from Van Damme, Bieke, Van Landeghem, Opdenakker, and Onghena (2002). Sample items are: "In my math class, I pay attention well," and "In my math class, I keep my attention on the work during the entire lesson." The scale (3 items) on classroom disruption was adapted from the PALS (Midgley et al., 2000), such as: "I sometimes behave in ways that annoy my teacher during math class," and "I sometimes disturb the lesson that is going on during math class."

Metacognitive self-regulation referred to students' use of metacognitive learning strategies in their mathematics study, including setting goals, monitoring, and effort regulation for understanding (Zimmerman, 2002). Disorganization referred to students' difficulty in applying a structured, organized approach to studying (Elliot, McGregor, & Gable, 1999). As in previous research (Fredricks et al., 2004; Greene, 2015; Jang et al., 2016), this study regarded use of self-regulation strategies and disorganization as cognitive dimensions of student engagement. The scale of metacognitive self-regulation (4 items) was adapted from existing instruments, including PISA

2003, Schraw and Dennison (1994), and Elliot, McGregor, and Gable (1999). Sample items include: “When I study math, I always start by figuring out exactly what I need to learn,” and “When something in math that I am studying gets difficult, I always spend extra time and effort trying to understand it.” The scale of disorganization (4 items) was adapted from Elliot, McGregor, and Gable (1999), such as: “I often find that I don’t know what to study or where to start in math,” and “I find it difficult to develop a study plan for math.”

An EFA using Proximal Axis Factoring extraction found that all the items loaded on the respective factor that they were supposed to measure, with the four factors explaining 67.35% of the variance in the items. After rotation using Oblimin with Kaiser Normalization method, factor loadings ranged from .55 to .87. Internal consistency alpha was .84, .80, .79, and .80, respectively, for classroom attention, classroom disruption, metacognitive self-regulation, and disorganization.

Statistical analysis

In general, the analyses included two steps. First, Rasch analysis was conducted to examine teaching practice and obtain person measures on perceived performance-focused teacher control and perceived learning-focused teacher support. Hierarchical linear modeling (HLM) was then run to examine gender and stream differences in these two teaching dimensions. Second, HLM was conducted to examine how these two teaching dimensions predict student engagement.

Results

Students’ perceived teaching practice

Rasch analysis was run separately with the two sets of items on perceived performance-focused teacher control and perceived learning-focused teacher support. To meet the requirement of unidimensionality, one general guideline is that the unexplained variance found in the 1st contrast from principal components analysis of the Rasch residuals should be less than 2—the

smallest amount for possibly having a second dimension (Linacre, 2016). The unidimensionality requirement was supported in both analyses: the unexplained variance in the 1st contrast of the Rasch residuals was 1.41 and 1.77, respectively, for perceived performance-focused teacher control and perceived learning-focused teacher support. A mean-square outfit statistic of less than 2 was used to decide whether the items fit the Rasch model (Linacre, 2016). All the items showed acceptable fit with mean-square outfit statistic ranging from .87 to 1.20 for perceived performance-focused teacher control, and from .69 to 1.84 for perceived learning-focused teacher support.

The Wright map obtained in Rasch analysis aligns person attribute measures and item difficulty measures on a common scale (Linacre, 2016). As shown in Figure 1, students are placed on the left side of the scale, and those who have higher person measures (more agreeable) are located higher on the scale. Items are placed on the right side of the scale, and items that are more difficult to agree with are located higher on the scale. Students are equally likely to agree and disagree with the items opposite them on the scale, and they are more likely to agree with the items lower on the scale and less likely to agree with items higher on the scale. By comparing the locations of items and students on the common scale, we can see that for performance-focused teacher control, in general, students tended to not endorse this dimension, especially those items on calling smart pupils more often and getting angry with students with opposing opinions (items located at the top). However, many students still tended to agree that their teachers compare how well they are doing with other pupils and want students to follow their pace even if students have difficulty keeping up (items located at the bottom). For learning-focused teacher support, in general, students tended to endorse this dimension, especially those items on teaching practice emphasizing the importance of understanding and trying hard (items located at the bottom). However, some students still tended to not agree that their teachers provide such support like

relating the topic to real life experiences, helping students appreciate the topic by using interesting activities or examples, and encouraging connecting topics and creative thinking (items located on the top).

Average person measures on the two teaching dimensions were compared using repeated measures analysis of variance (The average difficulty of items was set to be 0 by default in Rasch analyses). It was found that the mean of person measures on perceived learning-focused teacher support (M = 1.60, SD = 1.94) was significantly higher (F (1, 3362) = 2326.79, $p < .001$) than the mean of person measures on perceived performance-focused teacher control (M = -.58, SD =1.27). Thus, in general, students tended to perceive their mathematics teachers to be more learning-focused supportive than performance-focused controlling.

Due to the hierarchical nature of the data, the variance of person measures in the two teaching dimensions was decomposed at student and class levels. It was found that 21.3% of the variance in performance-focused teacher control and 17.6% of the variance in learning-focused teacher support were at class level. The correlation between these two teaching dimensions was -.30 ($p < .001$) at student level and -.59 ($p < .001$) at class level, suggesting teachers who were perceived as performance-focused controlling tend to be not perceived as learning-focused supportive.

HLM was run to examine gender and stream difference in the two teaching dimensions based on person measures. The dependent variable was each of the two teaching dimensions, the predictor at student level was gender (grand mean centred) and the predictor at class level was stream. It was found that both gender (β = -0.22, $p < .05$) and stream (β = -0.49, $p < .001$) significantly predicted perceived performance-focused teacher control, but did not significantly predict perceived learning-focused teacher support. Boys (M = -.29, SD = 1.19) perceived teaching practice to be more performance-focused controlling than did girls (M = -0.75, SD = 1.29). Low-

achieving students from the normal stream (*M* = -0.31, *SD* = 1.22) perceived teaching practice to be more performance-focused controlling than did high-achieving students from the express stream (*M* = -0.77, *SD* = 1.28). There was no significant cross-level interaction between gender and stream. These findings are consistent with previous studies that reported that boys and low-ability students tended to perceive their classroom teaching practice to be more performance-focused (Anderman & Midgley, 1997; Luo, Hogan, et al., 2011).

Perceived teaching practice and student engagement

As shown in Table 1, the intra-class correlations indicate that only a small portion of variance (3.5% - 8.8%) in the engagement variables were due to variations at class level. At both student and class levels, students' perceived performance-focused teacher control was positively associated with classroom disruption and disorganization, and students' perceived learning-focused teacher support was positively associated with classroom attention and metacognitive self-regulation. In addition, compared with girls, boys tended to report higher scores on all the four engagement variables. At class level, students from the normal stream reported more classroom disruption and disorganization than did students from the express stream.

HLM was conducted to predict each of the four engagement variables by the two teaching dimensions (all standardized). In HLM models, perceived performance-focused teacher control and perceived learning-focused teacher support were predictors at both student and class levels. Gender was added as a predictor at student level and stream as a predictor at class level. All the predictors at student level were grand-mean centred so that they were controlled when calculating the prediction of class level predictors.

The regression coefficients in HLMs are shown in Table 2. At student level, gender negatively predicted classroom attention, classroom disruption, and metacognitive self-regulation.

This indicates that compared with girls, boys reported more attention in mathematics class and more use of metacognitive self-regulation strategies, but they also reported more disruptive classroom behaviors. At student level, perceived performance-focused teacher control positively predicted classroom disruption, metacognitive self-regulation, and disorganization; perceived learning-focused teacher support positively predicted both classroom attention and metacognitive self-regulation. In addition, on classroom disruption, there was a positive interaction between students' perceived performance-focused teacher control at student level and both performance-focused teacher control and learning-focused teacher support at class level. It means that in classrooms higher in either teaching dimension, individual students' perceived performance-focused teacher control was a more positive predictor of classroom disruption. On classroom disruption, there was also a negative interaction between students' perceived learning-focused teacher support at student level and stream at class level. More specifically, in the express stream, students' perceived learning-focused teacher support was a more negative predictor of classroom disruptive behaviors.

After controlling for gender and perceived teaching practice at student level, stream negatively predicted classroom disruption and disorganization at class level, meaning that low-achieving students from the normal stream tended to have more classroom disruptive behaviors and they were more disorganized in their learning. In addition, perceived performance-focused teacher control positively predicted disorganization at class level.

Discussion

This study examined how Singapore Secondary students perceived teaching practice in their mathematics classrooms and how perceived teaching practice predicted student engagement. First, it was found that participants tended to perceive teaching practice of their mathematics teachers to

be more learning-focused supportive than performance-focused controlling. Second, this study found that in general perceived learning-focused teacher support positively predicted student engagement (classroom attention and metacognitive self-regulation), while perceived performance-focused teacher control positively predicted disengagement (classroom disruption and disorganization). Theoretical and practical implications of the findings are discussed in the following sections.

Perceived teaching practice in Singapore mathematics classrooms

In this study, teaching practice was examined by linking two motivational perspectives: classroom goal emphasis (Ames, 1992) and teacher support versus control grounded in SDT (Deci et al., 1996). Based on students' perceptions of teaching practice, the results of Rasch analysis in this study provided good support for the integration of the two motivational perspectives (Patrick et al., 2011; Urdan & Schoenfelder, 2006). When teachers emphasize relative performance in examinations, they may tend to use performance evaluation, competition, and deadlines as means to control/regulate student learning. In other words, performance-focused teachers may not value students' motivational needs in their learning. For example, they may keep telling students what to do, and want students to follow their pace even if students have difficulty keeping up. In contrast, when teachers emphasize learning and improvement, they may tend to pay attention to students' motivational needs and resources. For example, they may clearly tell students what learning goals to achieve, check student understanding before moving to the next topic in class, and provide scaffolding to facilitate student thinking and feedback to move student learning forward (structure support). They may also help students appreciate the topic by linking it to their real-life experience, stimulate creative thinking and original ideas, and encourage self-regulation (autonomy support).

Participants in this study perceived teaching practice of their mathematics teachers to be more learning-focused supportive than performance-focused controlling. Although this study did not compare the teaching practice before and after the launch of TLLM, the finding might be related to this reform initiative in view of the paramount emphasis given to it in the education system and the strong support provided to teachers. However, it does not mean that competitive performance in examinations is not important. In effect, it is argued that the assessment practice in Singapore is still dominated by high-stakes national examinations (Ratnam-Lim & Tan, 2015) and students' performances in national high-stakes examinations are still crucial and will continue to determine their educational and future success (Luo, Lee, & Chong, 2015). However, at least from students' perceptive, the findings in this study suggest that their mathematics teachers now give much attention to the motivating aspect of their teaching practice. The findings of Rasch analysis also suggest that teachers can do more to support student learning by meeting their motivational needs, especially for boys and low-achieving students. More specifically, teachers can reduce performance comparison between students, listen to the opinions of students (e.g., about the pace of teaching and learning), help students appreciate what they are learning by relating it to their real-life experience or designing interesting activities, and encourage creative and deep thinking. Hopefully, this will be achieved in future when students' competition in academic performance is further reduced and holistic development is given more emphasis in the education system of Singapore.

Perceived teaching practice and student engagement

This study found that students' perceived learning-focused teacher support positively predicted classroom attention and metacognitive self-regulation, while students' perceived performance-focused teacher control positively predicted classroom disruption and

disorganization in learning. This finding is consistent with previous research on both classroom goal emphasis (Friedel et al., 2007; Greene et al., 2004; Luo, Hogan, et al., 2011; Schiefele & Schaffner, 2015; Shim et al., 2013; Wolters, 2004) and teacher support versus control based on SDT (Cheon & Reeve, 2015; Jang et al., 2016; Jang et al., 2010; Reeve & Jang, 2006; Sierens et al., 2009; Skinner et al., 2008). However, it should be noted that this study also found that students' perceived performance-focused teacher control showed a positive prediction of metacognitive self-regulation. As also reported in previous studies (Wang & Holcombe, 2010; Wolters, 2004), this finding suggests that an emphasis on approach-oriented competition in performance may promote students to regulate their cognition and effort in their study. However, such an performance emphasis often tends to lead students towards "demonstrating positive characteristics, pleasing others, and validating one's worth" (Elliot & Moller, 2003, p. 345), and thus students become vulnerable to maladaptive learning as found in both this and previous studies, such as disruptive behaviors, disorganization, negative affect, use of avoidance strategies, cheating, and reluctance to cooperate with peers (Luo, Paris, Hogan, & Luo, 2011; Midgley, Kaplan, & Middleton, 2001). Therefore, a performativity culture in global education may lead to performance-focused controlling practice of teachers, which results in disengagement of students (Ball, 2003; Gorur, 2016; Ratnam-Lim & Tan, 2015; Zhao, 2017). For classroom teachers in Singapore, the findings of this study suggest that despite emphasis on competitive performance in high-stakes examinations, it is very important to provide learning-focused teacher support to engage students in the most immediate classroom contexts.

Furthermore, this study found that individual students' perception of teaching practice was more important to predict student engagement than the more objective average perception of teaching practice at class level. At class level, only performance-focused teacher control showed

a significant positive prediction of student disorganization in learning. However, this study also found some interactions between student level and class level predictors on classroom disruption. In classes higher on either performance-focused teacher control or learning-focused teacher support, when individual students perceived their teachers to be more performance-focused controlling, they would show more disruptive behaviors. It is possible that students who perceive classroom practice to be performance-focused controlling might adopt performance achievement goals (for reviews, see Meece et al., 2006; Rolland, 2012). As a result, a class high in performance-focused teacher control might provide additional pressure to them and a class high in learning-focused teacher support might also lead to a frustrating experience because of the different definitions of success (Lau & Nie, 2008; Murayama & Elliot, 2009). In addition, in classes from the express stream, individual students' perception of low learning-focused teacher support predicted more classroom disruptive behaviors, suggesting that compared to low-achieving students, high-achieving students might want to have a classroom climate that focuses more on learning and be given more autonomy and structure support.

It should be noted that low-achieving students from the normal stream tended to report more classroom disruptive behaviors and disorganization in their learning. Thus, these students need more motivational support from their teachers. However, this study also found that low-achieving students tended to perceive their teachers to be more performance-focused controlling. This might be explained by the reciprocal relationship between teaching and student engagement. For example, it was found that when teachers perceived their students to be externally regulated in their learning, they tended to provide less support to meet students' motivational needs (Pelletier, Seguin-Levesque, & Legault, 2002). More recently, Jang et al. (2016) reported that student disengagement predicted increases of their perceived teacher control and decreases of their perceived teacher

support over time. Therefore, rather than focusing on improving low-achieving students' performance through controlling practice, teachers should attend to their motivational needs, and provide motivational support to enhance their engagement in learning.

Limitations and directions for future research

This study had some limitations, based on which directions for future research are suggested. First, the measurement of all the variables was based on self-reports of students. Despite satisfactory structural validity found in this study, students' interpretations of the items might not be very accurate (Koskey et al., 2010). Future research can include different ways to collect data, such as classroom observation and interviews. Second, despite a prospective design, the findings in this study cannot fully establish the causality between teaching practice and student engagement. As discussed above, there could be a reciprocal relationship between the two aspects, that is, not only teaching practice in classrooms can influence student engagement, the latter can also affect the motivational support that teachers provide to students. Therefore, more research is needed to examine the reciprocal and dynamic relationship between teaching practice and student engagement through data collection at multiple time points and using more immediate measures of engagement (Greene, 2015). Third, this study collected data on teaching practice in Singapore Secondary 2 mathematics classrooms in 2013. Researchers can investigate whether the findings can be replicated with current students and in other subject domains or levels. In addition, this study only measured student engagement in behavioral and cognitive dimensions. Future research should examine how the two types of teaching practice predict student engagement in a broader sense and also more objective measures of student outcomes, such as academic achievement.

Acknowledgements

I am grateful to the research team in NIE led by Professor David Hogan. My experience of working and learning in the team had inspired me to further my research on classroom practice in this project [OER 13/12 LWS]. I would also like to thank Dr. Pak Tee Ng for his valuable advice given in the process of writing this paper.

References

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology, 84*, 261-271.

Anderman, E. M., & Midgley, C. (1997). Changes in achievement goal orientations, perceived academic competence, and grades across the transition to middle-level schools. *Contemporary Educational Psychology, 22*, 269-298.

Assor, A., Kaplan, H., Kanat-Maymon, Y., & Roth, G. (2005). Directly controlling teacher behaviors as predictors of poor motivation and engagement in girls and boys: The role of anger and anxiety. *Learning and Instruction, 15*, 397-413.

Assor, A., Kaplan, H., & Roth, G. (2002). Choice is good, but relevance is excellent: Autonomy-enhancing and suppressing teacher behaviors predicting students' engagement in schoolwork. *British Journal of Educational Psychology, 72*, 261-278.

Ball, S. J. (2003). The teacher's soul and the terrors of performativity. *Journal of Education Policy, 18*(2), 215-228.

Boekaerts, M. (2016). Engagement as an inherent aspect of the learning process. *Learning and Instruction, 43*, 76-83.

Cheon, S. H., & Reeve, J. (2015). A classroom-based intervention to help teachers decrease students' amotivation. *Contemporary Educational Psychology, 40*, 99-111.

Church, M. A., Elliot, A. J., & Gable, S. L. (2001). Perceptions of classroom environment, achievement goals, and achievement outcomes. *Journal of Educational Psychology, 93*, 43-54.

Deci, E. L., Ryan, R. M., & Williams, G. C. (1996). Need satisfaction and the self-regulation of learning. *Leaning and Individual Differences, 8*(3), 165-183.

Elliot, A. J., & McGregor, H. A. (2001). A 2 x 2 achievement goal framework. *Journal of Personality and Social Psychology, 80*(3), 501-519.

Elliot, A. J., McGregor, H. A., & Gable, S. L. (1999). Achievement goals, study strategies, and exam performance: A mediational analysis. *Journal of Educational Psychology, 91*(3), 549-563.

Elliot, A. J., & Moller, A. C. (2003). Performance-approach goals: Good or bad forms of regulation? *International Journal of Educational Research, 39*, 339-356.

Elliot, A. J., Murayama, K., & Pekrun, R. (2011). A 3 x 2 achievement goal model. *Journal of Educational Psychology, 103*(3), 632-648.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*, 59-109.

Fredricks, J. A., Wang, M. T., Linn, J. S., Hofkens, T. L., Sung, H., Parr, A., & Allerton, J. (2016). Using qualitative methods to develop a survey measure of math and science engagement. *Learning and Instruction, 43*, 5-15.

Friedel, J. M., Cortina, K. S., Turner, J. C., & Midgley, C. (2007). Achievement goals, efficacy beliefs and coping strategies in mathematics: The roles of perceived parent and teacher goal emphases. *Contemporary Educational Psychology, 32*, 434-458.

Gorur, R. (2016). Seeing like PISA: A caution tale about the performativity of international assessments. *European Educational Research Journal, 5*(5), 598-616.

Greene, B. A. (2015). Measuing cognitive engagement with self-report scales: Reflections from over 20 years research. *Educational Psychologist, 50*(1), 14-30.

Greene, B. A., Miller, R. B., Crowson, H. M., Duke, B. L., & Akey, K. L. (2004). Predicting high school students' cognitive engagement and achievement: Contributions of classroom perceptions and motivation. *Contemporary Educational Psychology, 29*, 462-482.

Haerens, L., Aelterman, N., Vansteenkiste, M., Soenens, B., & Petegem, S. V. (2015). Do perceived autonomy-supportive and controlling teaching relate to physical education students' motivational experiences through unique pathways? Distinguishing between the bright and dark side of motivation. *Psychology of Sport and Exercise, 16*, 26-36.

Hogan, D., Chan, M., Rahim, R., Kwek, D., Aye, K. M., Loo, S. C., . . . Luo, W. (2013). Assessment and the logic of instructional practice in Secondary 3 English and mathematics classrooms in Singapore. *Review of Education, 1*(1), 57-106.

Jang, H., Kim, E. J., & Reeve, J. (2016). Why students become more engaged or more disengaged during the semester: A self-determination theory dural process model. *Learning and Instruction, 43*, 27-38.

Jang, H., Reeve, J., & Deci, E. L. (2010). Engaging students in learning activities: Is it not autonomy support or structure but autonomy support and structure. *Journal of Educational Psychology, 102*(3), 588-600.

Kaplan, A., Gheen, M., & Midgley, C. (2002). Classroom goal structure and student disruptive behavior. *British Journal of Educational Psychology, 72*, 191-211.

Koskey, K. L. K., Karabenick, S. A., Woolley, M. E., Bonney, C. R., & Dever, B. V. (2010). Cognitive validity of students' self-report of classroom mastery goal structure: What students are thinking and why it matters. *Comtemporary Educational Psychology, 35*, 254-263.

Lau, S., & Nie, Y. (2008). Interplay between personal goals and classroom goal structures in predicting student outcomes: A multilevel analysis of person-context interactions. *Journal of Educational Psychology, 100*(1), 25-29.

Linacre, J. M. (2016). *A user's guide to Winsteps Mnistep Rasch Model Computer-Programs*.

Luo, W., Hogan, D., & Paris, S. G. (2011). Predicting Singapore students' achievement goals in their English study: Self-construal and classroom goal structure. *Learning and Individual Differences, 21*, 526-535.

Luo, W., Lee, K., & Chong, I. H. K. (2015). Do competitive performance goals and cooperative social goals conflict? A latent interaction analysis. *Learning and Individual Differences, 39*, 186-192.

Luo, W., Paris, S. G., Hogan, D., & Luo, Z. (2011). Do performance goals promote learning? A pattern analysis of Singapore students' achievement goals. *Contemporary Educational Psychology, 36*, 165-176.

Maehr, M. L., & Midgley, C. (1996). *Transforming school cultures*. Boulder, CO: Westview Press.

Meece, J. L., Anderman, E. M., & Anderman, L. H. (2006). Classroom goal structure, student motivation and academic achievement. *Annual Review of Psychology, 57*, 487-503.

Midgley, C., Kaplan, A., & Middleton, M. (2001). Performance approach goals: good for what, for whom, under what circumstances, and at what cost? *Journal of Educational Psychology, 93*, 77-86.

Midgley, C., Maehr, M. L., Hruda, L. Z., Anderman, E., Anderman, L., & Freeman, K. E. (2000). *Manual for the Patterns of Adaptive Learning Scales (PALS).* Ann Arbor: University of Michigan.

Ministry of Education. (2010). Building a national education system for the 21st century: The Singapore experience. Retrieved from http://www.edu.gov.on.ca/bb4e/Singapore_CaseStudy2010.pdf

Murayama, K., & Elliot, A. J. (2009). The joint influence of personal achievement goals and classroom goal structures on achievement relevant outcomes. *Journal of Educational Psychology, 101*(2), 432-447.

Ng, P. T. (2008). Educational reform in Singapore: From quantity to quality. *Educational Research for Policy and Practice, 7*, 5-15.

Park, S. Y. (2005). Student engagement and classroom variables in improving mathematcis achievement. *Asia Pacific Education Review, 6*(1), 87-97.

Patrick, H., Kaplan, A., & Ryan, A. M. (2011). Positive classroom motivational environments: Convergence between mastery goal structure and classroom social climate. *Journal of Educational Psychology, 103*, 367–382.

Pelletier, G. L., Seguin-Levesque, C., & Legault, L. (2002). Pressure from above and pressure from below as determinants of teachers' motivation and teaching behaviors. *Journal of Educational Psychology, 94*, 186-196.

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

Reeve, J., & Jang, H. (2006). What teachers say and do to support students' autonomy during a lerning activity. *Journal of Educational Psychology, 98*(1), 209-218.

Reeve, J., Jang, H., Carrell, D., Jeon, S., & Barch, J. (2004). Enhancing students' engagement by increasing teachers' autonomy support. *Motivation and Emotion, 28*, 147-169.

Reeve, J., & Tseng, C.-M. (2011). Agency as a fourth aspect of students' engagement during learning activities. *Contemporary Educational Psychology, 36*, 257-267.

Rolland, R. G. (2012). Synthesizing the evidence on classroom goal structures in middle and secondary schools: A meta-analysis and narrative review. *Review of Educational Research, 82*(4), 396-435.

Schiefele, U., & Schaffner, E. (2015). Teacher interests, mastery goals, and self-efficacy as predictors of instructional practices an student motivation. *Contemporary Educational Psychology, 42*, 159-171.

Schraw, G., & Dennison, R. S. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology, 19*, 460-475.

Shim, S. S., Cho, Y., & Wang, C. (2013). Classroom goal structures, social achievement goals, and adjustment in middle school. *Learning and Instruction, 23*, 69-77.

Sierens, E., Vansteenkiste, M., Goossens, L., Soenens, B., & Dochy, F. (2009). The synergistic relationship of perceived autonomy support and structure in the prediction of self-regulated learning. *British Journal of Educational Psychology, 79*, 57-68.

Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagment across the school year. *Journal of Educational Psychology, 4*, 571-581.

Skinner, E. A., Furrer, C. J., Marchand, G., & Kindermann, T. A. (2008). Engagement and disaffection in the classroom: Part of a larger motivational dynamic. *Journal of Educational Psychology, 100*(4), 765-781.

Skinner, E. A., Kindermann, T. A., & Furrer, C. J. (2009). A motivational perspective on engagement and disaffection: Conceptualization and assessment of children's behavioral

and emotional participation in academic activities in the classroom. *Educational and Psychological Measurement, 69*, 493-525.

Tapola, A., & Niemivirta, M. (2008). The role of achievement goal orientations in students' perceptions of and preferences for classroom environment. *British Journal of Educational Psychology, 78*, 291-312.

Tsai, Y. M., Kunter, M., Ludtke, O., Trautwein, U., & Ryan, R. M. (2008). What makes lessons interesting? The role of situational and individual factors in three school subjects. *Journal of Educational Psychology, 100*(2), 460-472.

Urdan, T., & Schoenfelder, E. (2006). Classroom effects on student motivation: Goal structures, social relationships, and competence beliefs. *Journal of School Psychology, 44*, 331-349.

VanDamme, J., Bieke, D. F., Van Landeghem, G., Opdenakker, M. G., & Onghena, P. (2002). A new study on educational effectiveness in secondary schools in Flanders: An introduction. *School Effectiveness and School Improvement, 13*(4), 383-397.

Wang, M. T., & Holcombe, R. (2010). Adolescents' perceptions of school environment, engagement, and academic achievement in middle school. *American Educational Research Journal, 47*(3), 633-662.

Wolters, C. A. (2004). Advancing achievement goal theory: Using goal structures and goal orientations to predict students' motivation, cognition, and achievement. *Journal of Educational Psychology, 96*, 236-250.

Zhao, Y. (2017). What works may hurt: Side effects in education. *Journal of Educational Change, 18*, 1-19.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice, 41*(2), 64-70.

Table 1

Intra-class Correlations & Correlations between Perceived Teaching and Student Engagement

	Classroom attention	**Classroom disruption**	**Metacognitive self-regulation**	**Disorganization**
Intra-class correlation	.060	.088	.035	.045
Student level				
Gender	-.07**	-.22**	-.09**	-.08**
Perceived performance-focused teacher control	-.07**	.27**	.01	.21**
Perceived learning-focused teacher support	.38**	-.10**	.37**	-.06**
Class level				
Stream	-.06	-.56**	-.13	-.44**
Perceived performance-focused teacher control	-.16	.58**	-.07	.60**
Perceived learning-focused teacher support	.56**	-.10	.52**	-.16

Note. * $p < .05$; ** $p < .01$.

Gender: 0 = male, 1 = female; Stream: 0 = normal stream, 1= express stream.

Table 2

Predicting Student Engagement by Perceived Teaching Practice

	Classroom attention	Classroom disruption	Metacognitive self-regulation	Dis-organization
Intercept				
Stream		-.24(.06)***		-.13(.06)*
Perceived performance-focused teacher control				.24(.12)*
Perceived learning-focused teacher support				
Slope of Gender				
Intercept	-.16(0.07)*	-.35(.10)***	-0.15(.08)*	
Stream				
Perceived performance-focused teacher control				
Perceived learning-focused teacher support				
Slope of perceived performance-focused teacher control				
Intercept		.25(.05)***	.16(.04)***	.15(.06)*
Stream				
Perceived performance-focused teacher control		.27(.10)**		
Perceived learning-focused teacher support		.21(.08)**		
Slope of perceived learning-focused teacher support				
Intercept	.42(.04)***		.45(.05)***	
Stream		-.11(.05)*		
Perceived performance-focused teacher control				
Perceived learning-focused teacher support				

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

Gender: 0 = male, 1 = female; Stream: 0 = normal stream, 1= express stream.

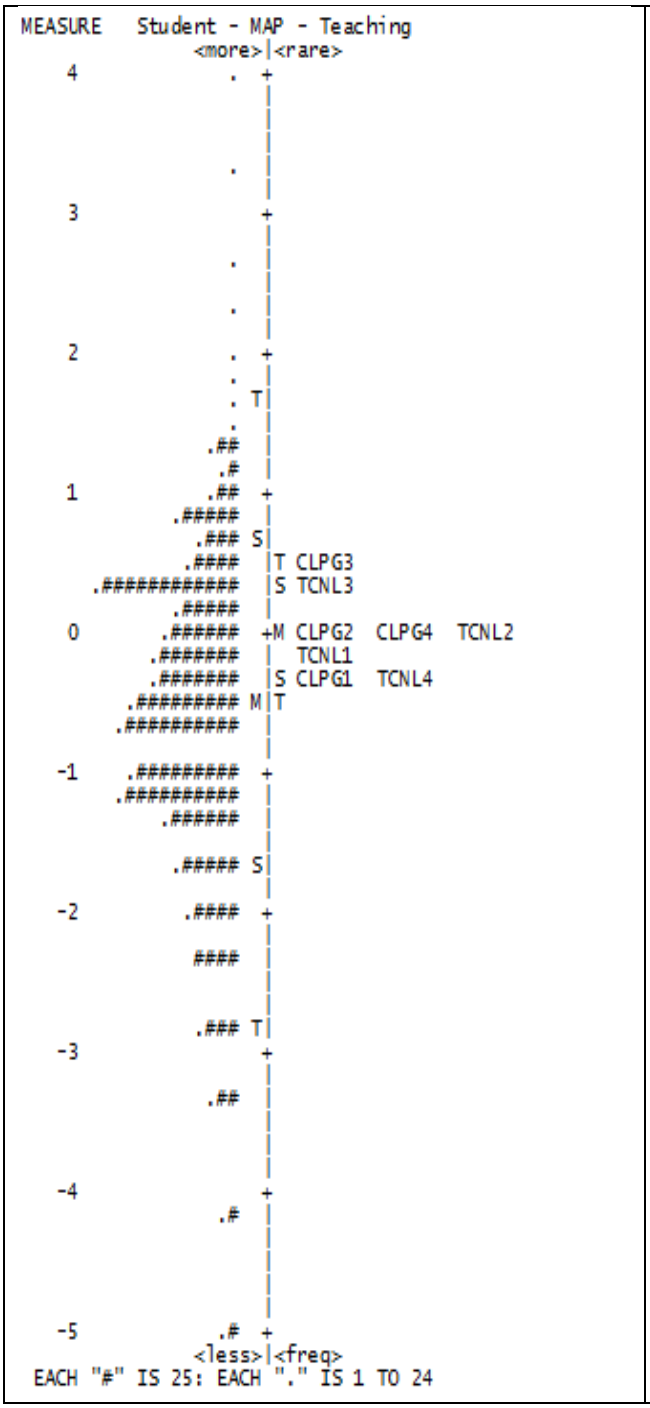
Figure captions

Figure 1. Wright map for perceived performance-focused teacher control.

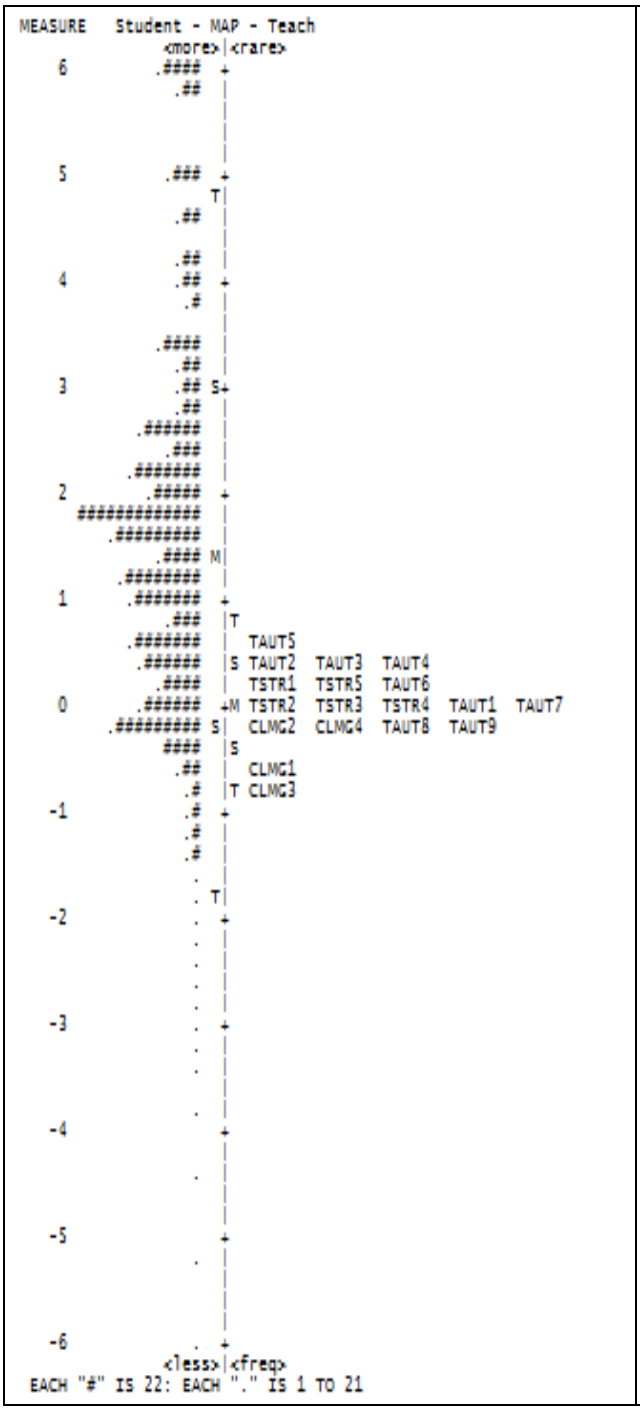
Note. Items from the top to the bottom are in the order of difficulty (from largest to smallest). Items in the same line are at the same difficulty level. TCNL= teacher control; CLPG = classroom performance goal emphasis.

Figure 2. Wright map for perceived learning-focused teacher support.

Note. Items from the top to the bottom are in the order of difficulty (from largest to smallest). Items in the same line are at the same difficulty level. CLMG = classroom mastery goal emphasis; TAUT = teacher autonomy support; TSTR = teacher structure support.



CLPG3 My math teacher calls on smart pupils more than other pupils.
TCNL3 My math teacher gets angry with students who oppose her/his opinions.
CLPG2 My math teacher is more concerned with our grades than what we learn.
CLPG4 My math teacher thinks that it is more important to do well in math tests than to learn new things.
TCNL2 My math teacher keeps telling us what to do and does not leave us much time to think.
TCNL1 My math teacher is only willing to listen to opinions that fit his/her views.
CLPG1 My math teacher always compares how well we are doing with other pupils.
TCNL4 My math teacher wants us to follow his/her pace even if we have difficulty keeping up.



TAUT5 My math teacher makes meanings of the topic by relating it to our real life experiences.
TAUT2 My math teacher asks us to think about the relations between the topics discussed.
TAUT3 My math teacher encourages creative thinking and original ideas.
TAUT4 My math teacher uses interesting examples and activities to help us appreciate the topic.
TSTR1 My math teacher clearly tells us the learning goals in each class.
TSTR5 After performing a task, my math teacher gives us clear feedback on how we did and what we need to do further.
TAUT6 My math teacher helps us understand how the activities and assignments in this class will be useful to us.
TSTR2 My math teacher explains to us the criteria of good work.
TSTR3 My math teacher provides us hints or tips when necessary to facilitate our thinking.
TSTR4 My math teacher checks our understanding before moving on to another topic in class.
TAUT1 My math teacher asks us challenging questions to make us think.
TAUT7 My math teacher encourages us to set our own goals of learning.
CLMG2 My math teacher wants us to really enjoy learning new things in math.
CLMG4 My math teacher allows us to make mistakes as long as we are learning
TAUT8 My math teacher asks us to check and correct errors in our own work.
TAUT9 My math teacher encourages us to take responsibility for our own learning.
CLMG1 My math teacher wants us to really understand the subject, not just to memorize facts or rules.
CLMG3 My math teacher tells us that it is very important to try hard.