



How Teaching Practices Affect Reading Literacy: A PISA 2018 Investigation on Southeast Asian Countries

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Abstract

Motivated by the role of teaching in what has been described as the “black box” of learning, the study problematizes the link of three individual teaching practices – direct instruction, adaptive teaching, and feedback – to student achievement in reading literacy in Brunei, Indonesia, Malaysia, the Philippines, and Thailand. Through a secondary analysis of PISA 2018, multiple regression models were fit to investigate the association between reading scores and measures of teaching practices reported by 35,000 students. The results showed a unique positive relationship between direct instruction and reading literacy in the Philippines, negative in Indonesia, Malaysia, and Thailand. Adaptive teaching related to higher reading literacy scores in all countries while feedback related to lower scores in all countries but Thailand. The findings have significant implications on the repositioning of these teaching practices in the Southeast Asian classroom, where the study asserts an imperative to close the gap between national policies on student-centered approaches and the persistence of traditional methods.

Keywords: direct instruction (DI), adaptive teaching, feedback, PISA, Southeast Asia

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教學實踐如何影響學生閱讀素養： 以東南亞國家PISA2018調查為例

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摘要

教師的教學實踐在學生學習歷程中扮演的角色，向來被認為是「黑盒子」般，需要進一步探究，本研究透過對「國際學生能力評量計畫」的次級資料分析，探討三種教學實踐模式——直接教學、適性教學和反饋——與學生閱讀素養成就之間的關係，研究對象為汶萊、印尼、馬來西亞、菲律賓和泰國五個國家的35,000名學生。以多元迴歸模型分析學生們的閱讀分數，與其所自陳之教師教學實踐模式間的關聯性。研究結果顯示：以「直接教學」而言，在菲律賓，其與閱讀素養之間存在獨特的正相關，而在印尼、馬來西亞和泰國則為負相關；相較於「適應性教學」與所有國家較高的閱讀素養分數都相關，而「反饋」模式則與除了泰國以外國家中較低的閱讀素養分數相關。此研究結果對東南亞課堂中重新定位不同教學實踐具有重要意義，也就是說，以學生為中心的教學實踐與堅持傳統講授法之間的差距應當被縮小。

關鍵詞：直接教學法、適應教學法、反饋、PISA、東南亞

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Introduction

Motivated by the growing importance of the measurable effects of education inputs on student learning, the Coleman Report (Coleman et al., 1966) signaled a long history of research on the impact of school, family, and student background factors on student achievement. While the report concluded the heaviest influence afforded by the student's background, a volume of other studies explored such inputs as student spending, peer effects, and various school factors like class size and school type, among others (Hanushek, 2020; Nye et al., 2004; Schneeweis & Winter-Ebmer, 2007; Woessmann, 2004). Also studied, albeit less commonly, were non-cognitive factors such as cultural capital, ambition, and institutional factors as in attending a private or public school (Barone, 2006; Dronkers & Robert, 2008). Of these, a smaller number further concentrate on the impact of the teacher on student achievement, from teacher education, training, and qualification to teacher experience; between the teacher's gender to their race; and across practices in the classroom (Schwerdt & Wuppermann, 2008).

Nye et al. (2004) demonstrated that teacher effects may be larger than school effects, implying that it may be more practical for educational policies to surround training or reorganizing teachers within a school than would be conducting whole-school reforms. Schools count particularly if they recognize active teachers who are consequently able to advance learning in the classroom (Wenglinsky, 2002). The teacher is an agent; they bring their training and development to the classroom and, in such manner, affect student achievement through instructional practices, which is why educational reforms have been manifest through the manipulation of the curriculum and pedagogical practices intended to translate effectively into high student

performance (Cohen & Hill, 1998). Wenglinsky (2002) found instructional practices to have the highest effect size among a host of teacher factors to student achievement; Klein et al. (2000) found mixed effects of reform teaching practices and generally negative effects of traditional practices; Hidalgo-Cabrillana and Lopez-Mayan (2018) similarly found the contrast between traditional and modern practices with the advantage to the latter; alternatively, Schwerdt and Wuppermann (2008), upon finding that lecture-style presentations related with higher achievement, purported that effective teaching practices may differ among grade levels.

In the context of Southeast Asia, the Southeast Asian Ministers of Education Organization (SEAMEO) (2018) recognizes the pivotal role of the teacher in student learning. Leaders of Southeast Asian education systems have standardized competencies required of teachers in each member country for the primary purpose of guiding professional development procedures towards developing students' 21st century skills, optimizing teacher effectivity by setting minimum performance standards among the region's five million teachers, facilitating regional mobility among teachers, and aligning Southeast Asian teacher competency with current global practices (SEAMEO, 2018). As one, Southeast Asian countries have recognized an insufficiency in the number and quality of teachers that the region faces and have put forward the demand for more qualified and motivated teachers to drive student learning (Sadiman, 2004).

This study sought to determine the association between three teaching practices – direct instruction (DI), adaptive teaching, and feedback – and student achievement in reading literacy in the countries of Brunei, Indonesia, Malaysia, Philippines, and Thailand. This study contributes to the recent attention on the importance of pedagogical practices as inputs to education by positioning the three practices against each other and assessing their respective

impact on student achievement. By leveraging the potential of using large-scale data from international assessments to redirect attention towards a dearth in Southeast Asian literature, the study expands this pedagogical line of inquiry across five geographical contexts and brings attention to how much teaching practices could help or only harm student achievement across the five Southeast Asian countries that all performed below the average Organization for Economic Co-operation and Development (OECD) score. The implications strive to deepen the current understanding on Southeast Asia and portray aspects of educational systems as large as Indonesia's or as small as Brunei's, both individually and as a region. Programme for International Student Assessment (PISA) secondary analyses employ either a single-country case design or a multi-country design that rarely discusses individual country results. The availability of comparative measures on teaching practices from PISA for the first time for Brunei and the Philippines provide an opportunity for understanding the region, drawing on both their similarities as a geographical region and their differences as cultures.

Current literature

Direct instruction

Founded on behavioral theory, which posits that the teacher creates the appropriate learning conditions to elicit a learning response in the student given a particular teaching stimulus (Adams & Carnine, 2003), a seemingly flawless, straightforward method underlies DI. Concepts that ground it are “high levels of student engagement within academically focused, teacher-directed classrooms using sequenced, structured materials” (Rosenshine, 1979, p. 17). The strict regard for careful planning and the teacher-leader eventually drew criticisms to DI, with terms such as “scripted,” “step-by-step,” and

“lockstep” having been associated with the approach (Alvermann, 2002, p. 201; Gersten & Carnine, 1986, p. 71; Readence & Tierney, 2005, p. 38). Additionally, along these lines of criticism runs parallel the most targeted aspect of DI: the lack of room for the learner’s creativity constrained by too high a structure and within too strict instructional parameters from which departures are not expected, being that the lesson is meticulously planned and prepared for (Kenny, 1980). Cited as a stimulus-response approach, DI is thought to create a spoon-feeding system that builds the teacher and the student on two opposite poles; the information comes from the teacher and the student receives it so there is no avenue provided for building something new (Readence & Tierney, 2005).

DI in the reading classroom

In the reading classroom, Rasinski et al. (2009) pointed out that difficulties in reading fluency can be addressed using modelling, repeated reading, and coaching techniques. Alvermann (2002) asserted the ongoing “reading wars” between the direct instruction of skills and other, more rounded teaching approaches. Inside the classroom, using DI means being able to supervise student behavior, keep classroom order, and efficiently handle time and material resources (Alvermann & Moore as cited in Alvermann, 2002; Hinchman & Zalewski, 1996). Outside the classroom, DI remains despite its reputation of rigidity because the same by-the-book structure answers to institutional demands; accountability demands that teachers be able to meet curriculum requirements and practice students for standardized tests above the school level.

Previous studies on DI

Baumann’s (1984) experiment on sixth graders showed that the treatment group using DI performed better main idea comprehension than the control

group. A later study by Carnine et al. (1997) revealed the positive influence of DI on the results of standardized tests among economically disadvantaged students. Shippen et al. (2005) found that different levels of DI improved the decoding skills of struggling middle schoolers. Findings by Borman et al. (2003) echo this; of all the 29 Comprehensive School Reform – a school improvement program in the United States – models studied, DI was one of the only three models to have demonstrated robust effects across a host of contexts and research designs, while the models, in general, could be expected to improve student achievement. Mostafa et al. (2018) used science achievement in PISA 2015 and found its positive association with DI in all participating countries except Indonesia and Korea, while Cordero and Gil-Izquierdo (2018) used PISA 2012 data and concluded the greater effect of traditional teacher-directed methods in math. Lastly, Stockard et al. (2018), in currently the biggest meta-analysis of DI studies, demonstrated the approach's enduring success especially in reading outcomes. They described consistently high and positive results for DI through 50 years' worth of research across different programs and subject areas, measures of outcome, research designs and methods, and control variables such as race, socioeconomic status (SES), and grade level.

DI in Southeast Asian research

In Southeast Asia, a Malaysian study conducted among a class of university learners of English concluded a dominance of the “direct method,” characterized by a focus on the role of the teacher in giving instructions, guiding the students, and providing them the answers (Sanjaya et al., 2014, p. 12). Another study portrayed a similarly strong emphasis on the central role of the teacher in the Malaysian classroom as explained by institutional pressures for academic achievement, pushing teachers to prioritize methods that

prepared students for exams and hence making it a challenge for them to use learner-centered approaches to teaching reading (Omar et al., 2011). In Brunei, DI is claimed as one of the teaching practices adopted in special education schools by learning assistance teachers who collaborate with regular teachers in identifying special needs among learners across different grade levels (Leong & Kooi, 2004).

Adaptive teaching

If DI assigns the teacher the pivotal role to lead the learning process, adaptive teaching, also called student-centered learning and individualized instruction in recent literature, is where the teacher shares ownership of the learning process with the students (Bernard et al., 2015; Vaughn et al., 2016). The need for adaptability on the part of the teacher was tackled as far back as the beginning of the 20th century by Dewey (1933), who grounded the concept in social constructivist theory. He painted the work of the teacher to be sensitive to individualized needs in the classroom, hence the individual contribution of each participant is brought to the table and ultimately everyone together constructs a part of the learning. Consequently, equally part of the construction of learning is the student's prior ability, current developmental stage, and unique learning styles (Stockard et al., 2018). Adaptive teaching has since been associated with terms that define its strength as an instructional approach: improvisation (Sawyer, 2004; Twiner et al., 2014), responsive teaching (Boyd, 2012), and the "co-creation of learning" between the student and teacher (Vaughn & Parsons, 2013). Scholars have asserted that it is impossible to perfectly plan the lesson and prevent deviations from it, especially as the teacher creates real-time modifications according to student responses and even incorporate novel components as needed in the discussion (Sawyer, 2004; Vaughn, 2019).

Adaptive teaching in the reading classroom

Dewey's (1933) view rings truer in the 21st century, where of increased importance is the growth of diversity in globalized classrooms (International Reading Association, 2012; Vaughn et al., 2016). Education production studies have concluded the significant power of such social contexts as SES and immigrant backgrounds in predicting low performance among students (OECD, 2018). Teaching that is adaptive, refuses to look past student differences, and instead makes them central to successful learning therefore becomes particularly important in the globalized classroom of the 21st century, marked by diversity and the challenge of providing equal chances to adolescents to complete their education beyond high school and eventually to participate effectively in the economy and society (OECD, 2018).

Previous studies on adaptive teaching

Consistent conclusions by meta-analyses as far as 35 years ago and as recent as the 21st century point to the robustness of adaptive teaching and student-centered approaches across levels of student outcomes, social and economic differences, and learner profiles. Waxman et al. (1985) sought to measure the empirical extent of the effect of adaptive teaching and measured a positive effect on student performance that is almost half the standard deviation. Meanwhile, through a meta-analysis of around 300 studies dated 2000 through 2017 on around 40,000 K-12 students from mostly the United States, Europe, and Australia, Bernard et al. (2015) presented evidence on the improvement of various student outcome measures through student-centered instruction, which they used synonymously with adaptive teaching. Moreover, Brühwiler and Vogt (2020), in measuring the competency of Swiss teachers in adaptive teaching, controlled for the class size, student SES, and language spoken at home, and revealed positive effects of adaptive teaching on the

science scores primary and secondary level students. In a study by Mostafa et al. (2018), adaptive teaching positively associated with science in all the PISA 2015 participating countries except Taiwan and Peru. With regard to student achievement in math, Shih et al. (2012) found the potential of adaptive teaching to increase performance among fifth graders in Taiwan, while Walker et al. (2014) proved the advantage of adaptive support to facilitate the impact of peer tutoring in the context of the United States.

Adaptive teaching in Southeast Asian research

Research on Southeast Asian pedagogical practices confirms the use of adaptive and individualized teaching in Bruneian and Malaysian special education (Leong & Kooi, 2004; Yusof et al., 2011). In the Philippine context, Reyes et al. (2018) underlined the importance of accounting for the learning needs of students of low SES by conceptualizing a model of teaching practices based on university faculty experiences while Maaliw III (2016) sought to develop a program to correctly assess and identify various learning needs and styles of university students. In Thailand, the National Education Act of 1999, which mandated the shift to learner-centered teaching approaches, saw an insistent use of the teacher-centered approach, which teachers preferred and were accustomed to before change was finally embraced (Kimhachandra, 2010; Songsiri, 2007; Saulprasertsri, 2017).

Feedback

With so long a history in research, the impact of feedback has merited revisits due to the multitude of perspectives on its effect on learning and performance, along with the challenge of delineating types of feedback that contribute to improving outcomes and ones that only exacerbate them. While cognitive theory posits that supportive classrooms supposedly allow for corrective feedback to activate the student's cognitive processes by giving

them information on what to do or how to improve (Klieme et al., 2009; Wisniewski et al., 2020), self-determination theory (Deci et al., 1991) suggests that the evaluation of one's performance affects their motivation. In the concept of a scaffolded instruction of reading strategies, feedback occupies a permanent role in the process, facilitating the teacher's scaffolding process as she or he serves as guide and support and gradually leads the student to independence (Phelps, 2005). Gersten and Carnine (1986) echoed the role of feedback in their model of scaffolding but with struggling readers, described as those who have yet to reach their full reading potential. In the area of adolescent literacy, feedback about progress is also deemed necessary to boost their self-efficacy and to help them better employ reading strategies (Alvermann, 2002; Schunk & Rice, 1993).

Feedback in the reading classroom

By claiming that feedback is the “consequence of performance,” Hattie and Timperley (2007, p. 81) highlighted its conditional nature, that is, the student must in the first place have a good understanding of the material in question before she can connect the purpose and point of the feedback given, seen here as the new piece of information, to the context of the subject matter, considered to be the existing information, in which she or he should better her performance. Heubusch and Lloyd (1998) elaborated on this contextualized impact of feedback when they learned that its influence on oral reading worked only if it was immediate, if the correct response was repeated by the student, and if the correction was specific to the material and the student. Correct feedback that is not clear and targeted can produce negative results on performance and degrade the student's image of him or herself (Thompson & Richardson as cited in Hattie & Timperley, 2007).

Previous studies on feedback

In revisiting feedback through a meta-analysis of over 400 studies, Wisniewski et al. (2020) asserted that even though the effects of feedback ranged between medium to high, these are highly varied and largely moderated by the vast expanse of feedback types, as simple as evaluating a singing performance or feedback on academic writing. They concluded that effective feedback has the following prerequisites: as much information as possible should accompany feedback; the student should be told why they made a mistake; and the student should be informed how to prevent the error from recurring (Wisniewski et al., 2020). Among many others, the impact of feedback on the student depended on the timing that it was given (delayed or immediate), the proficiency level of the learner, whether students were certain of their answers that elicited correction, and whether the feedback was in reference to their peer's performance or their own previous performances, which could lead to discouragement on the part of the student (Shute, 2008).

Feedback in Southeast Asian research

In Southeast Asia, several studies from Malaysia explored feedback types used by teachers across different learner levels (Farid & Samad, 2012; Fook & Nazamud-din, 2017; Mahmud, 2018; Noor et al., 2010; Razali et al., 2011). In Indonesia, Zacharias (2007) echoed the importance of feedback in her study of students' perception of teacher feedback in an English department. Aside from the students' trust in feedback because of the classroom authority culturally associated with teachers, findings include students' preference for feedback that is explicit, direct, and expressed in terms that are familiar to them. In Philippine literature, Magno (2010) highlighted the value of feedback in his study on the effect of scaffolding, defined in the study as instruction supervised by an adult and coupled with feedback, on the reading performance

of Filipino first graders. Thai studies have focused on immediate and delayed feedback; in a study on computer-assisted language learning, Khamkhien (2012) confirmed that English learners in the country receive immediate feedback from their teachers, while Sarifah (2019) concluded that primary school students' preference for immediate or delayed feedback relied on their level of competency in English.

Data and methodology

The study used data from the 2018 round of PISA on Brunei, Indonesia, Malaysia, Philippines, and Thailand. An international assessment of students' math, science, and reading skills, PISA also obtains information on the student, her background and family information, and other possible factors to student achievement. Moreover, a questionnaire is answered by the school to provide relevant school-level data. For this study, the student and school datasets were merged using the PISA-generated ID of the student's school. The variables of interest were identified, with only observations without non-responses for each variable kept, resulting to a final student sample size of 34,799 students and 1,026 schools from the five countries (see Table 2 for individual country sample sizes).¹

¹ Singapore was not included because a) it had an above-average performance and above-average variation of 109 standard deviation points in reading, reported by the OECD (2019b) to be one of the highest among all participating countries, while the five other SEA countries placed on the low-variation end of the spectrum; and b) it has no available data on the student's "language most used at home", one of the covariates used in this study. Vietnam participated as well but was not included in this study because the OECD (2019b) had declared the incomparability of its data.

Variables

Independent variables: student-reported teaching practices

PISA 2018 asked students to determine their observation of the three teaching practices by asking them, “How often do these things happen in your ‘test language lessons’?” Each item asked them to choose one response from four options, 1 corresponding to “every lesson,” 2 to “most lessons,” 3 to “some lessons,” and 4 to “never or hardly ever.” There were four items corresponding to the construct of DI, three items to the construct of adaptive teaching, and another three to the construct of feedback (see Table 1). The student-reported practices concern observations about only the teacher in the language of their PISA test (e.g., the respective English teacher of the student in Brunei). For comparability across countries, whereby zero is assigned as the OECD average, PISA uses Item Response Theory to convert and summarize the responses to the four DI items into one index named *dirins*, three adaptive teaching items into an index named *adaptivity*, and three feedback items to into a third index named *perfeed*. This study made use of these three indices as the measures of the teaching practices.

Dependent variable: student achievement in reading literacy

The results in reading literacy were reported as 10 plausible values (PV) for each student, named *pv1read* through *pv10read*, which are “random numbers drawn from the distribution of scores that could be reasonably assigned to each individual” (Adams & Wu, 2003, p. 107). Population statistics, as in the case of large-scale international assessments like PISA, does not concern individual student scores nor make inferences on the student level (Adams & Wu, 2003). Instead, PVs allow studying the performance of a population because they produce consistent population estimates (OECD,

Table 1 PISA 2018 Student Questionnaire Items on the Teaching Practices

Direct instruction	<ol style="list-style-type: none"> 1. The teacher sets clear goals for our learning. 2. The teacher asks questions to check whether we have understood what was taught. 3. At the beginning of a lesson, the teacher presents a short summary of the previous lesson. 4. The teacher tells us what we have to learn.
Adaptive teaching	<ol style="list-style-type: none"> 1. The teacher adapts the lesson to my class's needs and knowledge. 2. The teacher provides individual help when a student has difficulties understanding a topic or task. 3. The teacher changes the structure of the lesson on a topic that most students find difficult to understand.
Feedback	<ol style="list-style-type: none"> 1. The teacher gives me feedback on my strengths in this subject. 2. The teacher tells me in which areas I can still improve. 3. The teacher tells me how I can improve my performance.

n.d.; Wu, 2005). To run estimations using all 10 plausible values and to account for survey complex designs in the estimation of sampling values, this study used Stata module *repest* (Avvisati & Keslair, 2020).

Covariates

Based on previous literature on factors that affect adolescent reading literacy (Chiu & McBride-Chang, 2006; Elley, 1992; Lau & Ho, 2015; Linnakyla et al., 2004), the factors identified as covariates in this study are the student's: a) gender, b) grade level during the exam, c) immigrant status, d) enjoyment in reading, and e) perceived competency in reading. The family factors are the a) SES and b) language at home, and c) cultural possessions at home, whereas the school factors are the a) percentage of girls enrolled in the school, b) class size averaged on school level, and c) students' SES averaged on the school level. The importance of student's language at home was drawn from whether it matched the student's test language or not. Enjoyment in reading (OECD, 2019d), perceived competency in reading (OECD, 2019c),

and cultural possessions are also included in the PISA results as indices. Student SES was reported in PISA as an index of the student's economic, social, and cultural status (ESCS) constructed using three different scales: the highest level of parents' education, their highest occupational level, and possessions at home, all as reported in the student questionnaire (OECD, 2019d). School mean class size was controlled in order to account for the wide range of class sizes that might affect the use of particular teaching practices, while each student's grade level at the time of the PISA test also had to be controlled because the dataset covered a wide range of grades that could afford students different skill levels.

More information on the covariates can be found in Appendix B, Table B1. Appendix C shows country correlation matrices on all the variables used in the study. Variance inflation statistics, as in Appendix D, show no instance of high multicollinearity (all VIF values are above 5 and tolerance values below 0.20) (Hutcheson, 2011) between the independent variables and covariates.

Empirical methodology

By theorizing that reading literacy achievement is impacted by DI, adaptive teaching, and feedback, this study operationalized an education production function that "relates various inputs to education including those of families, peers, and schools to the maximum level of student achievement that can be obtained" Hanushek (2020, p. 161). Research that explores education outcomes from an input-output perspective has looked into a multitude of factors that affect performance and skill acquisition among students, from traditional inputs such as school resources (Li, 2016; Sousa & Armor, 2010; Suggate, 2009), background-related factors such as SES (Jerrim, 2012; Turmo, 2004; Woessmann, 2004), and non-cognitive factors such as the student's

ambition and engagement (Barone, 2006; Linnakyla et al., 2004). An OLS model was used to investigate the linear relationship between each of the three teaching practices and student achievement in reading literacy, that is, to estimate how much reading literacy changes with a one-unit increase in each teaching practice (Hutcheson, 2011). As an extension of simple linear regressions, multiple linear regressions are distinguished by examining the relationship between one dependent variable and several independent variables. The study used this method over simple linear regression, given the three independent variables, and because it allowed calculating the “effect that each explanatory variable has on the response variable whilst controlling for other variables in the model” (Hutcheson, 2004, p. 21).

Following a standard education production function, the estimation equation using the output of student achievement in reading literacy and the inputs of three teaching practices is shown in Models 1 and 2, run separately for each of the five countries. To identify the main effects, that is, the association with only the independent and dependent variables without the covariates, the proposed equation (1) was formulated:

$$Y_{isc} = \beta_0 + \beta_1 DIT_{isc} + \beta_2 AT_{isc} + \beta_3 FT_{isc} + \varepsilon_{isc} \quad (1)$$

where Y is the reading literacy score of student i in school s in country c ; T is a vector of each teaching practice index (DIT for DI, AT for adaptive teaching, and FT for feedback) per student i in school s and country c ; and ε_{isc} is the error term. β_0 as the Y -intercept is the value of Y if the coefficients of the other variables are zero, while β_1 , β_2 , and β_3 are the coefficients of interest. It must be noted that while multiple regression models regress one single dependent variable on several independent variables, the effect of one independent variable is calculated and interpreted while controlling for the other variables

in the model, securing no interaction between all three independent variables.

Guided by the research framework where various school, family, and peer factors affect student achievement scores, Model 2 illustrated by equation (2) added covariates to control for their effects on the relationship between the independent and dependent variables:

$$Y_{isc} = \beta_0 + \beta_1 DIT_{isc} + \beta_2 AT_{isc} + \beta_3 FT_{isc} + \gamma x_{isc} + \varepsilon_{isc} \quad (2)$$

where x_{isc} is a vector of covariates such as listed in Table 3. By adding x_{isc} to the equation, the study aimed to see the change in β_1 , β_2 , and β_3 (i.e., the coefficients of each teaching practice) once student, family, and school factors are controlled. For example, controlling for the student's SES might change the effect of adaptive teaching on reading literacy or controlling for the gender might change the effect of feedback on reading literacy.

Results

Descriptive statistics

Among the three teaching practices, DI has the highest mean index in Indonesia (0.75), the Philippines (0.72), and Thailand (0.53) (see Table 2). These positive values indicate that the country indices are all above the OECD average. As in Figure E1 (see Appendix E), the results from individual DI items in PISA 2018 offer a closer look at student-reported DI instances in the classroom of their language of assessment (i.e., English class in Brunei and the Philippines, Indonesian class in Indonesia, Malay and English classes in Malaysia, and Thai class in Thailand).

Mean adaptive teaching is highest in Thailand (0.22), closely followed by the Philippines (0.20) and Malaysia (0.18). It is lowest in Indonesia (0.09) and

Table 2 Descriptive Statistics, By Country

	BRN	IDN	MYS	PHL	THA
Sample size <i>N</i>					
Schools	55	309	190	187	285
Students	6145	8619	5754	6186	8095
Dependent variable					
Reading literacy scores	415.49 (96.51)	377.59 (74.58)	418.21 (83.67)	347.87 (79.61)	394.84 (78.22)
Independent variable: Index of teaching practices					
DI	0.22 (0.85)	0.75 (0.96)	0.39 (0.93)	0.72 (0.96)	0.53 (1.04)
Adaptive teaching	0.08 (0.78)	0.09 (0.97)	0.18 (0.83)	0.20 (0.93)	0.22 (0.96)
Feedback	0.33 (0.86)	0.36 (0.94)	0.44 (0.86)	0.36 (0.91)	0.14 (0.88)
Categorical covariates					
Gender					
Girls	3,113	4,436	2,963	3,341	4,417
Boys	3,032	4,183	2,791	2,845	3,678
Grade level at exam					
Grade 7	1	148	0	190	10
Grade 8	26	619	0	690	58
Grade 9	372	3,909	238	3,191	1,684
Grade 10	3,633	3,661	5,499	2,084	6,091
Grade 11	1,839	242	17	28	252
Grade 12	267	40	0	3	0
Grade 13	7	0	0	0	0
Language at home					
Test language	718	4,394	3,985	340	7,920
Other	5,427	4,225	1,769	5,846	175
Immigrant status					
Native	5,620	8,600	5,666	6,143	8,029
First-generation immigrant	190	10	62	17	48
Second-generation immigrant	335	9	26	26	18
Continuous covariates measured as indices					
SES	-0.24 (0.96)	-1.56 (1.10)	-0.75 (1.05)	-1.36 (1.12)	-1.30 (1.16)
Cultural possessions at home	-0.12 (0.87)	-0.40 (0.81)	-0.39 (0.87)	-0.43 (0.90)	-0.38 (0.81)
Enjoyment in reading	0.27 (0.85)	0.50 (0.61)	0.41 (0.72)	0.56 (0.81)	0.27 (0.63)

Table 2 Continue

	BRN	IDN	MYS	PHL	THA
Perceived reading competency	-0.28 (0.77)	0.03 (0.77)	-0.05 (0.79)	-0.04 (0.78)	-0.26 (0.76)
Percentage of girls in school	0.50 (0.22)	0.51 (0.15)	0.50 (0.14)	0.51 (0.06)	0.50 (0.18)
Class size	24.22 (5.02)	30.21 (12.22)	32.46 (8.56)	43.93 (7.89)	36.31 (8.09)

Note. BRN is Brunei, IDN is Indonesia, MYS is Malaysia, PHL is Philippines, and THA is Thailand. Sample sizes *N* are indicated for categorical covariates. Continuous covariates are reported as indices where 1 is the standard deviation and 0 is the OECD average.² Standard deviations are in parentheses.

Brunei (0.08), the only country among five where students are tracked after primary school according to their ability level. These mean indices are further detailed by percentages of student responses to individual items of adaptive teaching (see Figure E2, Appendix E). Compared to DI, instances of adaptive teaching in the five countries are less frequent.

Among the five countries, mean feedback is highest in Malaysia (0.44) and lowest in Thailand (0.14). Like DI and adaptive teaching, country mean feedback indices in the five countries are all higher than the OECD average. Except in Thailand, feedback is more frequently reported by students than adaptive teaching. Figure E3 (Appendix E) presents the percentages of student responses to feedback items in PISA 2018.

Table 2 shows individual country sample sizes, mean reading scores, and country indices of the variables of interest. Of the five, Malaysia has the highest mean reading score, Brunei comes in second, and the Philippines last. The size of each component of categorical variables is indicated per country.

² Negative indices indicate that “a respondent answered less positively than other respondents did on average across OECD countries,” not necessarily that the student answered negatively in the question (OECD, 2019d, p. 212).

In all countries, girls outnumber boys by a small percentage. In Brunei, grade levels range from 7 to 13, while Malaysia has the fewest grade levels, from 9 through 11. The language at home is indicated as the test language (e.g., English in the Philippines, Bahasa Indonesia in Indonesia) if the student's test language is their home language and as other if it is anything but the home language. Only in Brunei and the Philippines did those students who did not speak their test language at home outnumber those who did. In Brunei where the test language was English, only 11.68% (718 students) of the total sample identified English as their home language; the remaining students spoke Malay (4,736 students), Chinese (367 students), Tagalog (28 students), and other Bruneian local languages (296 students). In the Philippines, only 5.5% (340 students) spoke English at home, while the rest spoke some other 19 local languages. Native students outnumbered first- and second-generation immigrants in all five countries, with Brunei having the highest percentages of immigrants at 3.1% and 5.5%, respectively.

Some covariates, like the independent variables, are also presented as indices. The mean country SES is highest in Brunei, followed by Malaysia, Thailand, the Philippines, and Indonesia. The index of cultural possessions at home is highest in Brunei and lowest in the Philippines. The Philippines also has the highest mean country index of reading enjoyment while students from Brunei and Thailand share the lowest value. As regards the student's perceived competency in reading, only Indonesia's mean index surpasses the OECD average, while the lowest perception of reading is among students in Brunei. The mean country percentage of girls enrolled in schools in the five countries ranges between 50% and 51%. Mean country class size is lowest in Brunei with 24.22 students and highest in the Philippines with 43.93 students.

Regression results

Separate regressions were done for each of the five countries. Table 3 shows the regression results of the first model while Table 4 shows the results from the second model. Model 1 was used to examine the relationship between each teaching practice and reading literacy without controlling for any student, family, or school factors, while Model 2 was to control for these factors in determining the relationship between the teaching practices and reading literacy. Higher adjusted R^2 values from Model 2 indicate that adding the covariates to the regression provided a better fit for accounting for the variance in reading scores explained by the variables. As such, comparing the coefficients of the teaching practices between Models 1 and 2 show that the covariates weakened the effect of the teaching practices on the students' reading scores.

Table 3 Individual Country Results of Model 1

	BRN	IDN	MYS	PHL	THA
DI	-5.43** (1.701)	-6.96*** (1.951)	-9.75*** (1.719)	6.13*** (1.803)	-4.44** (1.482)
Adaptive teaching	26.68*** (1.799)	8.14*** (1.890)	24.23*** (2.290)	16.16*** (1.935)	11.77*** (2.025)
Feedback	-1.75 (1.553)	-10.14*** (2.234)	-4.934* (2.084)	-13.94*** (2.174)	-6.04*** (1.747)
Constant	415.0*** (1.187)	385.7*** (4.141)	419.9*** (3.231)	345.3*** (4.460)	395.4*** (3.332)
Adjusted R^2	0.039*** (0.00514)	0.024** (0.00798)	0.043*** (0.00741)	0.036*** (0.00698)	0.015** (0.00468)
F statistic	83.84*** (11.39)	70.62** (24.08)	87.62*** (15.52)	78.78*** (15.53)	42.12** (13.02)

Note. Standard errors are presented in parentheses.

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

Table 4 shows that generally lower scores are observed among boys than girls from all five countries. Test-home language-matched students in Brunei and Malaysia scored significantly higher than those who were not, while in the Philippines this former group scored interestingly lower than the latter. Only in Indonesia do both first and second-generation immigrants scored lower than their native peers, while in Brunei they scored significantly higher than natives. Higher reading scores are observed among students from higher SES families, students with greater enjoyment in reading, and greater perception of their reading ability, consistent in all five countries. As for school-level factors, higher scores were observed among higher-SES schools, while the percentage of girl enrollees seemed to be important in raising reading scores only in Malaysia and Thailand. Bigger school mean class size is associated with higher reading scores in Brunei.

Table 4 Individual Country Results of Model 2

	BRN	IDN	MYS	PHL	THA
DI	0.91 (1.350)	-4.20** (1.438)	-5.42*** (1.332)	2.35* (1.141)	-2.94** (1.015)
Adaptive teaching	12.45*** (1.622)	5.88*** (1.572)	12.00*** (1.449)	8.19*** (1.142)	3.33* (1.396)
Feedback	-4.85*** (1.261)	-6.61*** (1.550)	-5.26*** (1.308)	-9.84*** (1.399)	-1.85 (1.379)
Grade 7 at exam	0 (.)	0 (.)		0 (.)	0 (.)
Grade 8 at exam	-28.64 (26.43)	26.37** (9.432)		10.59* (4.831)	-10.51 (24.54)
Grade 9 at exam	-7.794 (23.38)	42.56*** (9.792)		38.87*** (4.347)	21.59 (22.35)
Grade 10 at exam	19.01 (24.28)	66.34*** (10.22)	84.65*** (4.835)	57.84*** (4.542)	31.39 (22.66)
Grade 11 at exam	38.00 (23.76)	68.06*** (11.47)	126.2*** (20.53)	99.97*** (11.32)	59.46** (22.96)

Table 4 Countine

	BRN	IDN	MYS	PHL	THA
Grade 12 at exam	83.98*** (23.21)	21.93 (13.05)		168.10*** (19.37)	
Grade 13 at exam	90.37** (32.67)				
Gender: Female	0 (.)	0 (.)	0 (.)	0 (.)	0 (.)
Gender: Male	-11.41*** (1.843)	-14.48*** (2.623)	-12.33*** (2.128)	-11.08*** (1.683)	-22.02*** (2.137)
Test language is not home language	0 (.)	0 (.)	0 (.)	0 (.)	0 (.)
Test language is home language	30.07*** (3.24)	-5.82 (3.50)	24.75*** (3.82)	-11.13* (4.73)	3.54 (2.84)
Immigrant status: Native	0 (.)	0 (.)	0 (.)	0 (.)	0 (.)
First-generation immigrant	19.37*** (5.398)	-75.23*** (18.16)	6.81 (11.58)	-12.63 (16.12)	-10.40 (14.19)
Second-generation immigrant	24.13*** (4.43)	-89.60*** (27.13)	-9.51 (23.48)	-33.83* (13.70)	66.54 (42.49)
SES	13.58*** (1.39)	6.13*** (1.38)	15.26*** (1.21)	10.47*** (1.20)	2.66* (1.19)
Cultural possessions at home	-12.68*** (1.145)	-5.99*** (1.670)	-3.80* (1.584)	-2.44* (1.085)	-3.81** (1.379)
Enjoyment in reading	16.59*** (1.327)	16.03*** (2.457)	13.70*** (1.608)	19.70*** (1.364)	12.09*** (1.780)
Perceived ability in reading	18.96*** (1.432)	0.688 (1.718)	11.77*** (1.256)	10.43*** (1.478)	11.79*** (1.582)
Class size	0.99*** (0.161)	0.25 (0.239)	0.23 (0.246)	0.025 (0.252)	-0.21 (0.295)
Percentage of girls in school	3.652 (3.972)	23.15 (21.38)	29.53* (14.29)	84.33 (63.91)	55.41*** (14.22)
Mean school SES	73.89*** (2.885)	37.43*** (4.154)	37.07*** (3.130)	41.94*** (4.181)	44.56*** (3.474)
Constant	384.6*** (25.19)	378.5*** (17.27)	340.0*** (11.49)	328.5*** (32.67)	414.1*** (27.32)

Table 4 Countine

	BRN	IDN	MYS	PHL	THA
Adjusted R^2	0.47*** (0.00684)	0.32*** (0.0343)	0.39*** (0.0236)	0.45*** (0.0242)	0.36*** (0.0247)
F statistic	269.7*** (7.401)	213.7*** (33.56)	233.9*** (23.22)	269.7*** (26.52)	255.6*** (27.28)

Note. Standard errors are presented in parentheses. A) Grade 7 at exam, B) Female, C) Test language is not home language, and D) Immigrant status: Native, all with values 0 are the reference groups for the respective categorical variables.

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

DI and student achievement

Results from Model 1 (see Table 3) suggest a significant relationship between DI and student achievement in reading literacy while controlling for the effects of adaptive teaching and feedback in all five countries. However, they have a positive relationship only in the Philippines, where a one-unit increase in DI is significantly associated with a 6.1-point increase in reading literacy. There is merit to examine this relationship again from the results of Model 2 (see Table 4). When all covariates, adaptive teaching, and feedback are controlled, the Philippines shows only a 2.3-point significant increase in reading literacy score per one-unit increase in DI, while the results for Brunei are no longer significant. For the three other countries, the association remains significantly negative, albeit weaker: a one-unit increase in DI is associated with 5.42 less reading literacy points in Malaysia, 4.20 less points in Indonesia, and 2.94 points less in Thailand.

The generally negative relationship between DI and student achievement in reading literacy contest what has been previously established as the dominantly positive and far-reaching effects of DI in student achievement. Large-scale meta-analyses by Borman et al. (2003), Hattie (2009), and

Stockard et al. (2018) have all portrayed the positive influence of DI on student achievement across a history of research spanning 50 years and diverse research and educational contexts. However, the tenets of DI within the paradigm of behavioral theory, which suppose particular learning conditions that elicit a response from the student given a stimulus (Adams & Carnine, 2003; Readence & Tierney, 2005), seem to fit the mastery of basic reading skills, but not the affective and social elements of literacy as defined in this study. According to Borich (2011, p. 226), DI is only recommended if the student is expected to learn beyond “facts, rules, and action sequences,” not when they should be developing skills such as reflecting on and processing material. PISA 2018 defined reading literacy as skills in understanding, using, evaluating, reflecting on and engaging texts that facilitate the achievement of the student’s goals, the development of their potential, and their participation in society, explicitly distinguished from simply decoding or reading texts aloud (OECD, 2019a).

The contrasting associations in DI against science as found by previous PISA studies (Cairns, 2019; Costa & Araújo, 2018; Jang-Jones, 2019; Mostafa et al., 2018) and against reading literacy point to possible conceptual and foundational differences between science and reading literacy to the more practical, interdisciplinary nature of literacy (Biancarosa, 2012; Goldman, 2012; Moje et al., 2008). Whereas inquiry-based practices are founded on constructivist approaches that, according to these PISA studies, do not seem to help with achievement in science, DI prescribes rigid structures that only relate to lower student achievement in reading literacy in Indonesia, Malaysia, and Thailand. In these countries, DI’s negative contribution to reading literacy illustrates the disconnect between its exact methodology as a pedagogical practice and the dynamic 21st century literacy competencies expected of an adolescent, especially with the increasing rise and importance of digital

literacy.

The unique case of the Philippines, where DI is positively associated with higher reading scores, might be attributed to its relatively wider low achievement in reading literacy compared to the four countries. Only 19% of the sampled students from the Philippines performed at Level 2 or higher of the PISA reading literacy proficiency scale (see Appendix A), the lowest share of Level 2 performers across the five countries (54% in Malaysia, 48% in Brunei, 40% in Thailand, and 30% in Indonesia) (OECD, 2019b). At the same time, while Brunei has 1% and Indonesia, Malaysia, and Thailand a negligible percentage of sampled students who performed at Levels 5 or 6, the Philippines had almost no student perform at these top levels of reading literacy (OECD, 2019b). The share of low-performing readers being largest in the Philippines among the five countries (and even across all participating countries) possibly draws the positive association between DI and reading literacy and, hence, the greater need for DI to master basic reading concepts and strategies to improve English literacy in the country. As is argued by the literature on DI in reading classrooms, independent reading could be left to already-fluent readers, while DI must be promoted among beginning and struggling readers in the form of modelling, assisting, or coaching (Rasinski et al., 2009; Salinger (2003). While this study does not assert the goodness of readers from Indonesia, Malaysia, and Thailand and the lacking performance of students from the Philippines, the findings ultimately point to the potential of DI as a teaching practice in helping struggling English readers in the Philippines.

Adaptive teaching and student achievement

The results of Model 1 (see Table 3) show that, while controlling for DI and feedback, adaptive teaching and student achievement in reading literacy

have significant positive relationships in all countries, with Brunei having the highest point increase (26.68 points) followed by Malaysia (24.23 points), then the Philippines (16.16 points), Thailand (11.77 points), and Indonesia (8.14 points). However, as in Model 2 (see Table 4), controlling for all covariates weaken these relationships, albeit still statistically significant. A one-unit increase in adaptive teaching is now significantly associated with an increase of 12.45 reading literacy points in Brunei, 12.00 points in Malaysia, 8.19 points in the Philippines, 5.88 points in Indonesia, and the smallest increase of 3.33 points in Thailand.

Unlike DI, adaptive teaching maintained a positive relationship with reading literacy associated with tailor-fitting the lesson to the student's proficiency level, providing individual help, and creating adjustments in the lesson according to student needs in all the five countries. The results were consistent; in all education systems, placing the learner's individuality in the center of the classroom instead of fitting one-size solutions to learning difficulties related to better reading literacy. While these findings support current literature on the positive effects of adaptive teaching on student achievement especially in K-12 contexts (Bernard et al., 2015; Cuevas et al., 2012), they also draw implications on adaptive teaching's contribution to maximizing the production of gains in reading literacy, especially at a time of the student's last years of basic formal education (Cuevas et al., 2012), as in this study. More particularly, these findings have specific implications on the role of adaptive teaching in issues of student diversity, pedagogical support especially for students from disadvantaged backgrounds, and the gap between teaching policy and practice in Southeast Asia.

Adaptive teaching caters to students of diverse needs and backgrounds. Current research confirms the favorable value of adaptive teaching among diverse student compositions (Mostafa et al., 2018; Vaughn et al., 2016).

Vaughn et al. (2016) described that the adaptive teacher knows their students well and can constantly assess them, but, relative to the other countries, this does not seem to be much of a problem in the Philippines and Thailand, which showed the highest indices of adaptive teaching despite having the highest country mean class size of 44 and 36 students, respectively. These results indicate that adaptive teaching relates to significant reading literacy gains even in large class sizes, where, following the Philippines and Thailand, the impossibility of increased adaptive teaching on the country level is not definite. The findings on Brunei, where the lowest index of adaptive teaching (0.08) is associated with the highest increase in reading literacy (12.45 points, see Table 4), strengthen the necessity of individualizing instruction in the English classroom.

Moreover, adaptive teaching entails supporting every student's learning, especially for the magnified needs of low-performing students and those from low-SES backgrounds (Mostafa et al., 2018), as is generally the case of the five countries in this study. While PISA trends have long shown that disadvantage is not destiny through the percentage of low-SES students capable of performing at par with their high-SES peers, SES is still identified as a strong predictor of student performance in PISA due to financial, cultural, and social resources afforded to a student from a high-SES background, which may be less available for their low-SES peers (OECD, 2016a). Although adaptive teaching is not the sole answer to improving student achievement, the results of this study depict quantifiable gains in reading literacy if inequalities in education inputs are targeted and adaptive teaching increased.

The findings further contribute to shifting the direction of policymaking in education that has continually sought for pedagogical practices that work best for students, especially since national governments in the five countries have incorporated in their education policies student-centered approaches that

take into account learner differences. Thailand, for example, has long mobilized a shift towards learner-centered methods (Kimhachandra, 2010). Likewise, the Philippine government specifically prescribes inquiry-based, collaborative approaches for its basic education curriculum, while Brunei puts maximum focus on the variety on students' learning styles (SEAMEO, 2017). However, Southeast Asian literature reveals a gap between policy and practice, since DI and other traditional approaches persist in the classroom. Accord to research on Brunei, DI has remained popular among teachers mainly because of institutional pressures towards high achievement and the teachers having easier teacher control and wanting to stick to traditional methods (Saxena, 2008; Sercombe & Tupas, 2014; Smith, 2011). In Indonesia and Malaysia, teachers similarly continually prefer DI because of personal preferences, institutional pressures on student performance, or a lack of understanding of newly implemented curricular policies (Omar et al., 2011; Sulfasyah & Barratt-Pugh, 2015). Meanwhile in Thailand, where the directive on student-centered teaching approaches was initially resisted before finally embraced by teachers, (Kimhachandra, 2010) still shows an index of adaptive teaching (0.22) lower than DI (0.53). Levels of DI and adaptive teaching from the PISA 2018 data show this tendency of teacher behavior from the student's perspective; the lowest index of DI in Brunei (0.22) is equivalent to only the highest index of adaptive teaching in Thailand. All of the five countries reported more instances of DI than adaptive teaching, an observation not only among Southeast Asian educational systems, but also among participating countries in PISA (OECD, 2010). The positive associations between adaptive teaching and reading literacy show that there is greater imperative, more than ever, to materialize government mandates on student-centered approaches, one of them adaptive teaching, in the classroom.

Feedback and student achievement

Based on the results of the first model (Table 3), feedback has a significantly negative relationship with student achievement in reading literacy in all five countries. This is highest in the Philippines, where a one-unit increase in feedback is associated with 13.94 points less in reading literacy, followed by Indonesia (10.14 points less), then Thailand (6.04 point less), Malaysia (4.93 points less), and Brunei (1.75 points less).

Results from Model 2 (Table 4) show a consistent pattern of negative associations, although the number of reading points either increased or decreased. After controlling for the covariates, a one-unit increase in feedback is now significantly associated with only 9.84 points less in the Philippines and 6.61 points less in Indonesia. In Malaysia, the decrease in points associated with feedback is now bigger (5.26 points less), as well as in Brunei (4.85 points less). In Thailand, the results of Model 2 are statistically insignificant.

Given theoretically and empirically founded assumptions on the success of feedback in positively influencing student performance, its general association with lower reading literacy in Southeast Asia, while insignificant results were obtained on Thailand, was unexpected. However, instead of suggesting that feedback be avoided by teachers of reading literacy, this study poses the challenge of creating more room to define measures of feedback that positively impacts student achievement. The findings run parallel with the findings of Mostafa et al. (2018) and Costa and Araújo (2018), who found negative results on feedback and student achievement, albeit in science, in their secondary analyses of data from PISA 2015. Mostafa et al. (2018) suggested that PISA's cross-sectional nature only provides a single snapshot of the workings of feedback in the classroom, while Costa and Araújo (2018) purported the probability of feedback being given mostly to low achieving

students. Additionally, this study asserts that the negative findings may be attributed on some level to the conditional nature of feedback described in research (Hattie & Timperley, 2007; Shute, 2008; Wisniewski et al., 2020). Hattie and Timperley (2007) for example, argued that before feedback could mean anything to the student, there should in the first place be a guarantee of the student's understanding of the learned material.

Conclusion

The study highlighted the potential of particular teaching practices to maximize student achievement in reading literacy. In Indonesia, Malaysia, and Thailand, educational policy reforms would do well to move from traditional pedagogical approaches and towards individualizing instruction of reading in their national languages in order to better foster equity in reading outcomes, especially across groups of SES and performance levels. In Brunei, while the inconclusive results on DI cannot confirm its worth in the English classroom, the favorable results on adaptive teaching point to the imperative for teachers to prioritize learner individualities in English literacy. In the Philippines, although adaptive teaching relates to higher points in reading literacy than does DI, implications underscore the importance of increasing both DI and adaptive teaching in English classes, a challenge that may accompany maintaining the quality of its mother-tongue based curriculum and especially if the country plans to take future international assessments in English.

Moreover, the findings portray a picture of the interplay between DI and adaptive teaching that is fraught with tension in a Southeast Asian context. First, DI facilitates the transfer of basic skills or lower-level concepts in reading literacy, but the use of adaptive teaching practices exhibits far stronger potential and takes on a new role towards developing adolescent readers.

Second, practice favors DI, but evidence favors adaptive teaching. In adaptive classrooms, adolescent readers are more able to demonstrate high-skilled processes of interpreting and evaluating information indicative of valuable 21st century literacy skills. Furthermore, there lies the challenge defining feedback that is effective in producing gains in student achievement. Unlike DI, feedback does not hold a conventionally unchallenged reputation, given the history of revisits to its effect in learning. At the same time, it is unlike adaptive teaching, which holds a clarity far from misinterpretation (i.e., adaptive teaching points to the sole direction of catering to individual students' needs). This study argues for the dynamic nature of feedback; that feedback is merely given to the student is not enough. Ultimately, the study lays out several implications on policy and further research.

Policy implications

Closing the gap between teaching policy and practice in the Southeast Asian classroom

By drawing the tension between DI and adaptive teaching, the findings point to the imperative to reassess the purpose of retaining teacher-centered pedagogical practices like DI that have persisted in the classroom because they are more popular among teachers, or teachers have not been trained to adopt student-centered approaches, or because of institutional pressures on high student achievement in standardized exams. Alternatively, the use of DI could be refocused and strengthened among struggling readers. For students in countries like Indonesia, Malaysia, and Thailand, the use of practices like DI's one-size lesson structures which no longer match students' varying needs and interests in their national language must be reconsidered, whereas in the Philippines, policies surrounding DI could be strengthened in English classes, especially because the country's current English curriculum aims at improving

performance in international assessments.

Aside from challenging the role of traditional methods that use a single yardstick to gauge learning progress, needs, and success, the use of adaptive teaching also serves as a significant step in the process of addressing inequalities in learning particularly among struggling high school readers and students from low-SES backgrounds in these countries. This study shows evidence on the indispensability of adapting the lesson and discussion to students' knowledge and needs in the Southeast Asian classroom.

Reassessing measures of effective feedback

The findings of this study aligning with previous PISA studies on the negative association between feedback and student achievement does not point to the abolishment of feedback in the classroom. There is merit to explore if the measures of feedback in PISA 2018 simply do not fit within the paradigm of effective feedback according to theory and research. In other words, because the PISA 2018 items on feedback only loosely pertains to comments on the student's a) strong points, b) areas for improvement, and c) ways to improve, it might be that they do not sufficiently encompass the aspect of feedback that is effective. What should follow from this study is an in-depth investigation on when and what type of feedback appropriately captures reading literacy among adolescents. Based on current research showing the internationally observed negative associations between feedback and student achievement, data could be obtained on a) a comprehensive snapshot of feedback and student performance over time, b) the direction of feedback across groups of student performance, and c) elements of feedback that more accurately portray activation of students' cognition and motivation.

Limitations and implications for further research

More room could be explored as regards the relationship between student

achievement and teaching practices by complementing the students' perceptions of the teaching practices with teacher-reported or researcher-observed classroom practices. Although PISA distributed a teacher questionnaire for the purpose of linking data on teachers, students, and schools, not all countries, including those in this study, answered the teacher questionnaire.

Furthermore, the sample, while sizeable, does not compare to instances of large populations of 15-year-olds in the Philippines or Indonesia. However, the study asserts that a sample as large as was available is still important in the case of developing countries such as the Philippines, whose first participation in PISA in 2018 has rendered its education system and national performance comparable with its neighbors. A richer dataset could be constructed using more PISA rounds' worth of results and would enable capturing multiple snapshots of instances of teaching practices that could influence reading literacy over time.

Lastly, the study is limited to its geographical context, rendering a persistent challenge to apply the findings on the relationship between the studied variables to other countries and regions.

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Appendix A PISA 2018 Reading Literacy Proficiency Levels

Level and lower score limit	Characteristics of tasks
6 698	<p>Readers at Level 6 can comprehend lengthy and abstract texts in which the information of interest is deeply embedded and only indirectly related to the task. They can compare, contrast and integrate information representing multiple and potentially conflicting perspectives, using multiple criteria and generating inferences across distant pieces of information to determine how the information may be used.</p> <p>Readers at Level 6 can reflect deeply on the text's source in relation to its content, using criteria external to the text. They can compare and contrast information across texts, identifying and resolving inter-textual discrepancies and conflicts through inferences about the sources of information, their explicit or vested interests, and other cues as to the validity of the information.</p> <p>Tasks at Level 6 typically require the reader to set up elaborate plans, combining multiple criteria and generating inferences to relate the task and the text(s). Materials at this level include one or several complex and abstract text(s), involving multiple and possibly discrepant perspectives. Target information may take the form of details that are deeply embedded within or across texts and potentially obscured by competing information.</p>
5 626	<p>Readers at Level 5 can comprehend lengthy texts, inferring which information in the text is relevant even though the information of interest may be easily overlooked. They can perform causal or other forms of reasoning based on a deep understanding of extended pieces of text. They can also answer indirect questions by inferring the relationship between the question and one or several pieces of information distributed within or across multiple texts and sources. Reflective tasks require the production or critical evaluation of hypotheses, drawing on specific information. Readers can establish distinctions between content and purpose, and between fact and opinion as applied to complex or abstract statements. They can assess neutrality and bias based on explicit or implicit cues pertaining to both the content and/or source of the information. They can also draw conclusions regarding the reliability of the claims or conclusions offered in a piece of text.</p> <p>For all aspects of reading, tasks at Level 5 typically involve dealing with concepts that are abstract or counterintuitive, and going through several steps until the goal is reached. In addition, tasks at this level may require the reader to handle several long texts, switching back and forth across texts in order to compare and contrast information.</p>
4 553	<p>At Level 4, readers can comprehend extended passages in single or multiple-text settings. They interpret the meaning of nuances of language in a section of text by taking into account the text as a whole. In other interpretative tasks, students demonstrate understanding and application of ad hoc categories. They can compare perspectives and draw inferences based on multiple sources.</p> <p>Readers can search, locate and integrate several pieces of embedded information in the presence of plausible distractors. They can generate inferences based on the task statement in order to assess the relevance of target information. They can handle tasks that require them to memorize prior task context.</p> <p>In addition, students at this level can evaluate the relationship between specific statements and a person's overall stance or conclusion about a topic. They can reflect on the strategies that authors use to convey their points, based on salient features of texts (e.g., titles and illustrations). They can compare and contrast claims explicitly made in several texts and assess the reliability of a source based on salient criteria.</p> <p>Tasks at Level 4 are often long or complex, and their content or form may not be standard. Many of the tasks are situated in multiple-text settings. The texts and the tasks contain indirect or implicit cues.</p>
3 480	<p>Readers at Level 3 can represent the literal meaning of single or multiple texts in the absence of explicit content or organizational clues. Readers can integrate content and generate both basic and more advanced inferences. They can also integrate several parts of a piece of text in order to identify the main idea, understand a relationship or construe the meaning of a word or phrase when the required information is featured on a single page.</p> <p>They can search for information based on indirect prompts, and locate target information that is not in a prominent position and/or is in the presence of distractors. In some cases, readers at this level recognize the relationship between several pieces of information based on multiple criteria. Level 3 readers can reflect on a piece of text or a small set of texts, and compare and contrast several authors' viewpoints based on explicit information.</p> <p>Reflective tasks at this level may require the reader to perform comparisons, generate explanations or evaluate a feature of the text. Some reflective tasks require readers to demonstrate a detailed understanding of a piece of text dealing with a familiar topic, whereas others require a basic understanding of less-familiar content.</p> <p>Tasks at Level 3 require the reader to take many features into account when comparing, contrasting or categorizing information. The required information is often not prominent or there may be a considerable amount of competing information. Texts typical of this level may include other obstacles, such as ideas that are contrary to expectation or negatively worded.</p>
2 407	<p>Readers at Level 2 can identify the main idea in a piece of text of moderate length. They can understand relationships or construe meaning within a limited part of the text when the information is not prominent by producing basic inferences, and/or when the text(s) include some distracting information.</p> <p>They can select and access a page in a set based on explicit though sometimes complex prompts, and locate one or more pieces of information based on multiple, partly implicit criteria.</p> <p>Readers at Level 2 can, when explicitly cued, reflect on the overall purpose, or on the purpose of specific details, in texts of moderate length. They can reflect on simple visual or typographical features. They can compare claims and evaluate the reasons supporting them based on short, explicit statements.</p> <p>Tasks at Level 2 may involve comparisons or contrasts based on a single feature in the text. Typical reflective tasks at this level require readers to make a comparison or several connections between the text and outside knowledge by drawing on personal experience and attitudes.</p>
1a 335	<p>Readers at Level 1a can understand the literal meaning of sentences or short passages. Readers at this level can also recognize the main theme or the author's purpose in a piece of text about a familiar topic, and make a simple connection between several adjacent pieces of information, or between the given information and their own prior knowledge.</p> <p>They can select a relevant page from a small set based on simple prompts, and locate one or more independent pieces of information within short texts.</p> <p>Level 1a readers can reflect on the overall purpose and on the relative importance of information (e.g. the main idea vs. non-essential detail) in simple texts containing explicit cues.</p> <p>Most tasks at this level contain explicit cues regarding what needs to be done, how to do it, and where in the text(s) readers should focus their attention.</p>
1b 262	<p>Readers at Level 1b can evaluate the literal meaning of simple sentences. They can also interpret the literal meaning of texts by making simple connections between adjacent pieces of information in the question and/or the text.</p> <p>Readers at this level can scan for and locate a single piece of prominently placed, explicitly stated information in a single sentence, a short text or a simple list. They can access a relevant page from a small set based on simple prompts when explicit cues are present.</p> <p>Tasks at Level 1b explicitly direct readers to consider relevant factors in the task and in the text. Texts at this level are short and typically provide support to the reader, such as through repetition of information, pictures or familiar symbols. There is minimal competing information.</p>
1c 189	<p>Readers at Level 1c can understand and affirm the meaning of short, syntactically simple sentences on a literal level, and read for a clear and simple purpose within a limited amount of time.</p> <p>Tasks at this level involve simple vocabulary and syntactic structures.</p>

Note. Descriptions retrieved from OECD (2019b).

Appendix B Variable Names and Description

Variables	Name	Description
Dependent variable		
Reading literacy	<i>pv1read to pv10read</i>	10 plausible values in reading generated by PISA for each student
Independent variables		
DI	<i>dirins</i>	Index generated by PISA from four questionnaire items: <i>ST102Q01TA</i> , <i>ST102Q02TA</i> , <i>ST102Q03TA</i> , <i>ST102Q04TA</i>
Adaptive teaching	<i>adaptivity</i>	Index generated by PISA from three questionnaire items: <i>ST212Q01HA</i> , <i>ST212Q02HA</i> , <i>ST212Q03HA</i>
Feedback	<i>perfeed</i>	Index generated by PISA from three questionnaire items: <i>ST104Q02NA</i> , <i>ST104Q03NA</i> , <i>ST104Q04NA</i>
Covariates		
Student characteristics		
Gender	<i>gender</i>	From the student questionnaire: Female = 1, male = 2)
Grade level at exam	<i>gradeatexam</i>	Student's international grade
Language at home	<i>testlanghomelang</i>	Dummy variable generated by the author to indicate if the test language (<i>LANGTEST_COG</i>) and home language (<i>LANGN</i>) match (=1) or not (=0)
Immigrant status	<i>immigrant</i>	Native, first generation, or second generation
Enjoyment in reading	<i>joyread</i>	Index of Joy/Like reading
Perceived reading competency	<i>screadcomp</i>	Index of Self-concept of reading: Perception of competence
Family characteristics		
Economic, social, and cultural status (ESCS)	<i>escs</i>	Index of economic, social, and cultural status generated by PISA
Cultural possessions at home	<i>cultposs</i>	Index of cultural possessions at home generated by PISA
School characteristics		
Percentage of girls in school	<i>girlspercent</i>	From the school questionnaire: Generated by the author $SC002Q02TA / (SC002Q01TA + SC002Q02TA)$
Class size	<i>clsiz</i>	Mean class size by school
School mean ESCS	<i>meanescs</i>	Manually calculated by the author

Appendix C Correlation between the Variables Used in the study, per country

Table C1 Brunei

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 pv@read	1.00***														
2 dirins	0.02	1.00***													
3 adaptivity	0.19***	0.35***	1.00***												
4 perfeed	0.06***	0.33***	0.42***	1.00***											
5 gender	-0.14***	0.01	-0.01	0.06***	1.00***										
6 gradelevelatexam	0.32***	0.01	0.07***	0.06***	-0.05***	1.00***									
7 testlanghomelang	0.32***	-0.03*	0.06***	0.04**	-0.02*	0.08***	1.00***								
8 immig	0.21***	-0.08***	0.02	-0.01	0.00	-0.01	0.14***	1.00***							
9 joyread	0.30***	0.08***	0.12***	0.09***	-0.34***	0.09***	0.15***	0.04**	1.00***						
10 screadcomp	0.35***	0.09***	0.19***	0.14***	-0.08***	0.12***	0.25***	0.07***	0.43***	1.00***					
11 escs	0.40***	0.03*	0.13***	0.08***	0.00	0.22***	0.30***	0.09***	0.13***	0.25***	1.00***				
12 cultpos	0.10***	0.06***	0.08***	0.08***	-0.06***	0.02	0.19***	0.04*	0.20***	0.23***	0.41***	1.00***			
13 clsiz	0.00	-0.07***	-0.05***	-0.08***	0.04***	-0.07***	0.01	0.08***	-0.03**	-0.06***	-0.03**	-0.04**	1.00***		
14 girlspercent	0.14***	0.03*	0.03**	-0.03*	-0.43***	0.05***	0.03*	0.00	0.22***	0.06***	0.07***	0.08***	-0.14***	1.00***	
15 meanschoolescs	0.55***	-0.5***	0.10***	0.04***	-0.04***	0.22***	0.33***	0.28***	0.10***	0.18***	0.48***	0.17***	-0.06***	0.15***	1.00***

Note. *pv@read* signifies that all PVs from *pv1read* to *pv10read* were used to compute the correlation.

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

Table C2 Indonesia

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 pv@read	1.00***														
2 dirins	-0.10***	1.00***													
3 adaptivity	0.01	0.29***	1.00***												
4 perfeed	-0.10***	0.34***	0.51***	1.00***											
5 gender	-0.17***	0.02	0.01	0.05**	1.00***										
6 gradelevelatexam	0.30***	-0.06**	-0.02	-0.08**	-0.11***	1.00***									
7 testlanghomelang	0.07*	-0.03	-0.01	0.02	-0.07**	0.00	1.00***								
8 immig	-0.07**	-0.03**	-0.02	-0.01	0.03*	-0.03**	0.03	1.00***							
9 joyread	0.13***	0.11***	0.12***	0.16***	-0.13***	0.02	0.00	-0.02*	1.00***						
10 screadcomp	0.02	0.12***	0.18***	0.22***	0.04*	-0.02	0.01	-0.02	0.40***	1.00***					
11 escs	0.31***	-0.08***	-0.03	-0.07**	0.01	0.14**	0.22***	0.05*	-0.02	0.00	1.00***				
12 cultpos	0.04	-0.01	0.02	0.03	0.04	-0.02	0.07**	0.03*	0.13***	0.10***	0.37***	1.00***			
13 clsiz	0.11*	-0.01	0.00	0.03	-0.08**	-0.05	0.13*	-0.04	-0.02	-0.04	0.07	-0.02	1.00***		
14 girlspercent	0.17***	-0.03	-0.01	0.00	-0.24***	0.16	0.03	0.00	0.07**	-0.05	0.06	-0.01	0.21*	1.00***	
15 meanschoolescs	0.44***	-0.12*	-0.03***	-0.09**	-0.05	0.21**	0.24***	-0.01	-0.02	-0.03	0.64***	0.24***	0.12	0.10	1.00***

Note. *pv@read* signifies that all PVs from *pv1read* to *pv10read* were used to compute the correlation.

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

Table C3 Malaysia

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 pv@read	1.00***														
2 dirins	-0.03	1.00***													
3 adaptivity	0.17***	0.39***	1.00***												
4 perfeed	0.02	0.44***	0.50***	1.00***											
5 gender	-0.16***	0.02	-0.03*	0.03**	1.00***										
6 gradelevelatexam	0.32***	0.02	0.07***	0.06***	-0.04*	1.00***									
7 testlanghomelang	0.23***	0.16***	0.09***	0.17***	0.00	0.27***	1.00***								
8 immig	-0.01	0.00	-0.01	0.00	0.00	-0.03	-0.03*	1.00***							
9 joyread	0.27***	0.12***	0.19***	0.17***	-0.28***	0.10***	0.11***	0.00	1.00***						
10 screadcomp	0.28***	0.16***	0.20***	0.22***	-0.1***	0.15***	0.24***	-0.01	0.45***	1.00***					
11 escs	0.40***	-0.09***	0.08***	-0.03	-0.01	0.08***	0.01	-0.02	0.11***	0.13***	1.00***				
12 cultpos	0.12***	0.02	0.08***	0.05**	-0.02	0.02*	-0.06**	0.03*	0.18***	0.14***	0.36***	1.00***			
13 clsiz	0.04	-0.03	0.01	-0.04	0.00	-0.02	-0.15*	-0.01	0.04	-0.01	0.05	0.02	1.00***		
14 girlspercent	0.13*	0.00	0.02	-0.04	-0.28***	0.02	-0.04	0.00	0.11***	-0.01*	0.06	0.02	-0.01	1.00***	
15 meanschoolescs	0.42***	-0.14***	0.05**	-0.10***	-0.02	0.04*	-0.02	0.04	0.07*	0.04	0.58***	0.20***	0.08	0.1	1.00***

Note. *pv@read* signifies that all PVs from *pv1read* to *pv10read* were used to compute the correlation.

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

Table C4 Philippines

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 pv@read	1.00***														
2 dirins	0.08***	1.00***													
3 adaptivity	0.13***	0.30***	1.00***												
4 perfeed	-0.04	0.29***	0.52***	1.00***											
5 gender	-0.17***	-0.09***	-0.03*	0.03*	1.00***										
6 gradelevelatexam	0.35***	0.09***	0.07***	0.02	-0.12***	1.00***									
7 testlanghomelang	0.02	-0.01	-0.04**	-0.04*	-0.01	-0.01	1.00***								
8 immig	-0.06***	-0.07***	-0.02	0.01	0.03*	-0.11***	0.00	1.00***							
9 joyread	0.32***	0.15***	0.13***	0.10***	-0.29***	0.10***	0.01	-0.04**	1.00***						
10 screadcomp	0.28***	0.17***	0.19***	0.17***	-0.10***	0.13***	0.03*	-0.06**	0.44***	1.00***					
11 escs	0.43***	0.01	0.05**	0.00	0.05**	0.19***	0.11***	0.02	0.08***	0.14***	1.00***				
12 cultpos	0.22***	0.03*	0.04**	0.03*	-0.03	0.07***	0.08***	0.03*	0.17***	0.18***	0.46***	1.00***			
13 clsiz	-0.12*	0.03	0.01	0.02	-0.01	-0.12**	-0.05	-0.01	0.03	-0.01	-0.15*	-0.02	1.00***		
14 girlspercent	0.19**	-0.04	0.01	-0.07*	-0.10**	-0.12	0.02	0.00	0.09**	0.03	0.13	0.08*	0.01	1.00***	
15 meanschoolescs	0.52***	-0.03	0.03	-0.06*	-0.01	0.17***	0.10**	0.00	0.05	0.09***	0.60***	0.29***	-0.24*	0.22	1.00***

Note. *pv@read* signifies that all PVs from *pv1read* to *pv10read* were used to compute the correlation.

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

Table C5 Thailand

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 pv@read	1.00***														
2 dirins	-0.02	1.00***													
3 adaptivity	0.09***	0.38***	1.00***												
4 perfeed	-0.02	0.30***	0.48***	1.00***											
5 gender	-0.24***	-0.01	-0.04**	0.13***	1.00***										
6 gradelevelatexam	-0.24***	-0.02	0.01	-0.03	-0.07***	1.00***									
7 testlanghomelang	0.19***	0.00	0.04*	0.01	0.00	0.12***	1.00***								
8 immig	-0.03	-0.01***	-0.01	0.00	0.01	-0.13***	-0.04*	1.00***							
9 joyread	0.22***	0.11***	0.17***	0.08***	-0.21***	0.01	-0.01	-0.01	1.00***						
10 screadcomp	0.22***	0.12***	0.18***	0.12***	-0.09***	0.04**	0.02	-0.04*	0.44***	1.00***					
11 escs	0.35***	-0.02	0.05*	0.03	0.03	0.23***	0.29***	-0.08**	0.06**	0.12***	1.00***				
12 cultposs	0.15***	0.04**	0.08***	0.05**	-0.02	0.07***	0.09***	-0.02	0.16***	0.18***	0.39***	1.00***			
13 clsiz	0.24***	-0.03	0.00	-0.01	-0.04	0.25***	0.14**	-0.05	0.01	0.03	0.32***	0.08**	1.00***		
14 girlspercent	0.27***	0.01	0.06***	-0.03	-0.35***	-0.03	0.03	-0.01	0.11***	0.10***	0.11	0.10**	0.13	1.00***	
15 meanschoolscs	0.51***	-0.05*	0.05*	0.00	-0.04	0.27***	0.34***	-0.09***	0.07*	0.08**	0.65***	0.26***	0.49***	0.17	1.00***

Note. *pv@read* signifies that all PVs from *pv1read* to *pv10read* were used to compute the correlation.

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

Appendix D VIF Statistics Per Country

	BRN		IDN		MYS		PHL		THA	
	VIF	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF	Tolerance	VIF	Tolerance
dirins	1.22	0.82	1.19	0.84	1.34	0.74	1.16	0.86	0.59	0.82
adaptivity	1.33	0.75	1.38	0.72	1.46	0.68	1.44	0.69	1.47	0.68
perfeed	1.30	0.77	1.46	0.69	1.53	0.65	1.43	0.70	1.39	0.72
gender	1.37	0.73	1.10	0.91	1.19	0.84	1.13	0.89	1.19	0.84
gradelevelatexam	1.10	0.91	1.17	0.85	1.09	0.92	1.10	0.91	1.13	0.88
testlanghomelang	1.21	0.83	1.09	0.92	1.19	0.84	1.02	0.98	1.17	0.85
immig	1.12	0.90	1.00	1.00	1.01	0.99	1.02	0.98	1.01	0.99
joyread	1.42	0.70	1.29	0.78	1.41	0.71	1.38	0.73	1.36	0.73
screadcomp	1.37	0.73	1.24	0.80	1.36	0.73	1.32	0.76	1.33	0.75
escs	1.61	0.62	2.01	0.50	1.70	0.59	1.82	0.55	2.39	0.42
cultpos	1.27	0.79	1.20	0.83	1.20	0.84	1.30	0.77	1.27	0.79
clsiz	1.05	0.96	1.05	0.95	1.03	0.97	1.10	0.91	1.03	0.97
girlspcent	1.30	0.77	1.08	0.92	1.11	0.97	1.08	0.92	1.16	0.86
meanschoolescs	1.54	0.65	2.01	0.50	1.56	0.64	1.70	0.59	2.36	0.42

Note. High multicollinearity is indicated by VIF values higher than 10 and tolerance values lower than 0.20 (Hutcheson, 2011).

Appendix E

Figure E1. Percentage of student responses to PISA 2018 items on DI, by country

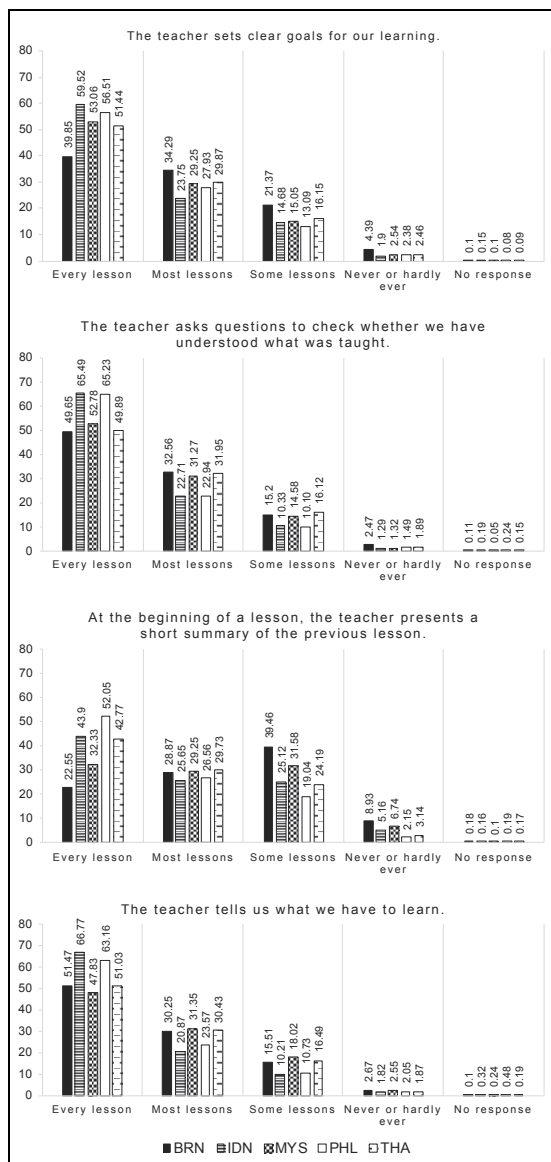


Figure E2. Percentage of student responses to PISA 2018 items on adaptive teaching, by country

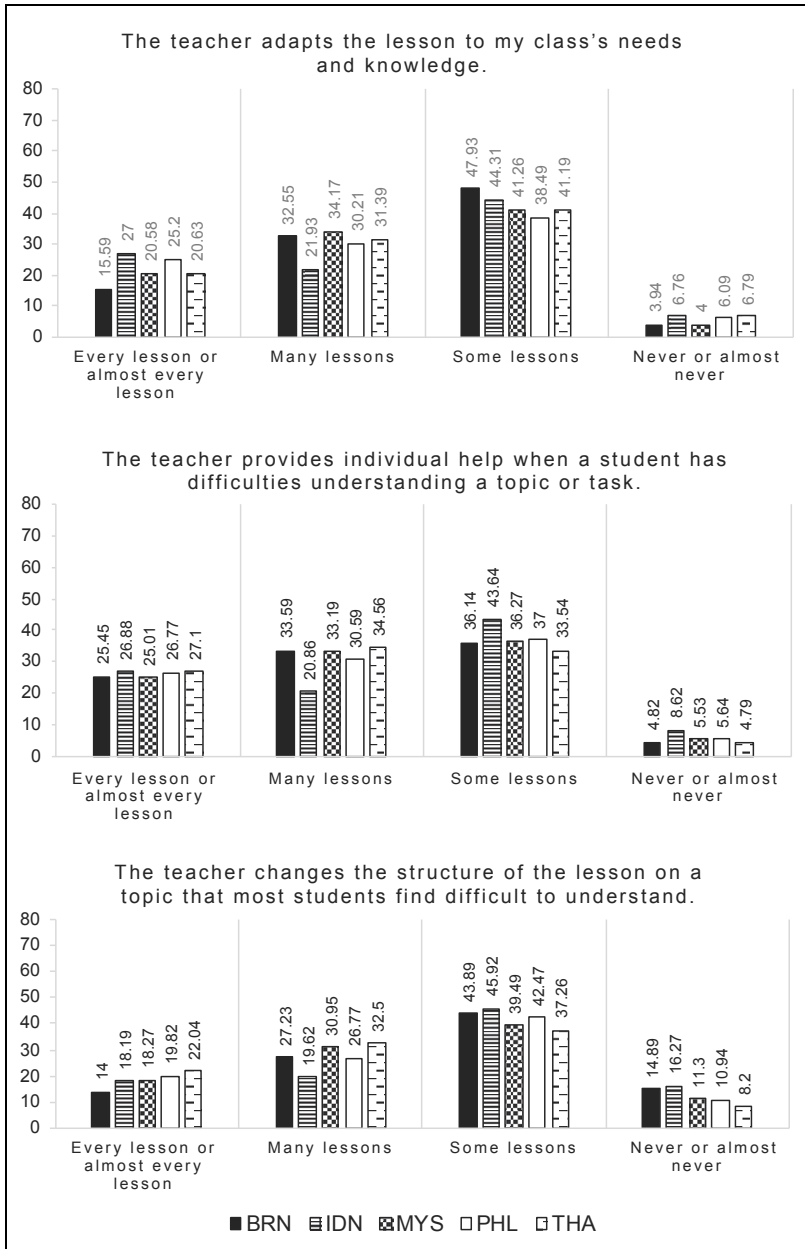


Figure E3. Percentage of student responses to PISA 2018 items on feedback, by country

