Interventions, Practices and Contextual Factors Linked to Indonesian Students' Literacy and Numeracy Outcomes:

A Systematic Review

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A Systematic Review

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Abstract

Despite the large number of reforms that have been implemented in Indonesia to improve education quality, there is not yet a systematic review that maps how these reforms and programs affect the quality of learning in Indonesia. This systematic review aims to understand the different studies have been undertaken in Indonesia so far, and how they link to student literacy and numeracy outcomes. The review team screened 2,693 potentially relevant studies that were obtained from a systematic search. The screening process selected 120 relevant studies. Based on the availability of data provided in the paper as well as the quality of the individual studies, only 25 individual studies (reporting 75 findings) are suitable for a meta-analysis. Several factors have been mapped based on the magnitude and direction of the effect to the student literacy or numeracy performance. Comparing pooled effect sizes between types of interventions, we can see that teaching and school factors have the highest pooled effect on both literacy and numeracy learning outcomes. Amongst school factors, principal preparedness to implement school-based management contributed the most to the numeracy learning outcomes. There is strong evidence that using teaching strategies based on students' needs and difficulties can improve learning outcomes. This review also suggest that teachers should have sufficient comprehension of the subject matter, pedagogical knowledge and adequate social skills to understand the problems in the classroom, and to choose and implement the most appropriate teaching strategy. Based on the quality assessment employed for all screened individual studies, the current review also strongly suggests that more rigorous studies on learning quality needs to be undertaken in Indonesia.

Keywords: learning outcomes, Indonesia, literacy, numeracy, systematic review, meta-analysis

Introduction

International tests of literacy and numeracy consistently place Indonesia among the poorest performers. While Indonesia was one of only a few countries showing improvements in its scores on the Programme for International Student Assessment (PISA) between 2000 and 2012 (OECD, 2014), it is still one of the lowest performing countries overall, and also compared to other participating countries in its region. Performance on such international learning assessments has been linked not just to the outcomes of individual students as adults (Breakspear, 2012) but also to countries' economic growth (Hanushek & Woessmann, 2009). For these reasons, improving student learning outcomes have increasingly become a priority in Indonesia.

The Indonesian government has significantly increased its public spending on education. Public education expenditure more than doubled in real terms between 2001 and 2009 (Chang et al., 2014). More attention is now being paid to whether this dramatic increase has had a positive effect on the outcomes and if it has not, what has gone wrong with this programme (van Trotsenburg, Chaves, Costin, Patinos, & Ragatz, 2015). At the same time, a number of education reforms, programs and interventions of varying scope have been implemented over the last two decades (OECD, 2015). While some of these have been found to have influenced educational attainment, the existing evidence shows very little or no returns on students' learning outcomes (de Ree, Muralidharan, Pradhan, & Rogers, 2015; OECD, 2015). In response to this situation, the Indonesian Ministry of Education and Culture (MoEC) set the 2015-19 strategic plan to focus on achieving a better quality of learning (Kementrian Pendidikan dan Kebudayaan, 2015). MoEC's Policy Research Centre (Puslitjakdikbud) plays a substantial role by providing comprehensive research evidence for policy making.

Policymakers and practitioners face a constant barrage of news and stories on new strategies, programs and products that can improve student learning. They often do not have the time to assess the evidence that underlies such claims or which intervention or strategy would actually help them improve student learning in their particular context. One of the greatest problems faced by schools is not resistance to innovation, but the "fragmentation, overload, and incoherence resulting from the uncritical and uncoordinated acceptance of too many different innovations" (Fullan, 1991, p.97).

This systematic review aims to provide a picture of the body of research on what factors contribute to the improvement of student learning outcomes in Indonesia. The findings will contribute to future research, interventions, and to provide an evidence base to assess whether particular types of interventions are likely to improve literacy and numeracy outcomes. It will also be used as a basis of engagement with education stakeholders; a starting point for discussions around the interventions, practices and factors that are most relevant to student learning.

Thousands of meta-analysis have been conducted in the field of education. Most prominently, John Hattie has published a synthesis of over 800 of these studies – a meta-meta-study – that focus on student achievement (Hattie, 2009). The findings have highlighted the importance of student self-expectations, the provision of formative assessments and feedback, classroom discussion, and teacher-student relationships, as well as specific approaches such as response to intervention,

reciprocal teaching and spaced practice. As most of the underlying studies were carried out in developed and English-speaking countries, therefore, Hattie has cautioned against generalizing his findings in other contexts.

More recently, academics and development partner researchers have undertaken systematic reviews (e.g. Asim, Chase, Dar, & Schmillen, 2015; Krishnaratne, White, & Carpenter, 2013; Masino & Niño-Zarazúa, 2015; Mcewan et al., 2013)as compared with \" business-as-usual \" in the same settings. The treatments included instructional interventions, health interventions, and incentive-based interventions. On average, monetary grants and deworming had effects that were close to zero and statistically insignificant. Nutritional treatments, treatments that provided information to parents or students, and treatments that improved school management and supervision had small mean effect sizes (0.04-0.06 on learning outcomes in developing countries, and in 2015 the World Bank published an analysis of six of such reviews. They found that three categories of programs were recommended with consistency: pedagogical interventions that tailor teaching to student skills (including those that use computer-assisted learning), repeated teacher training interventions that are usually linked to other pedagogical interventions, and in certain contexts, strengthening accountability through contracts or performance incentives (Evans & Popova, 2015).

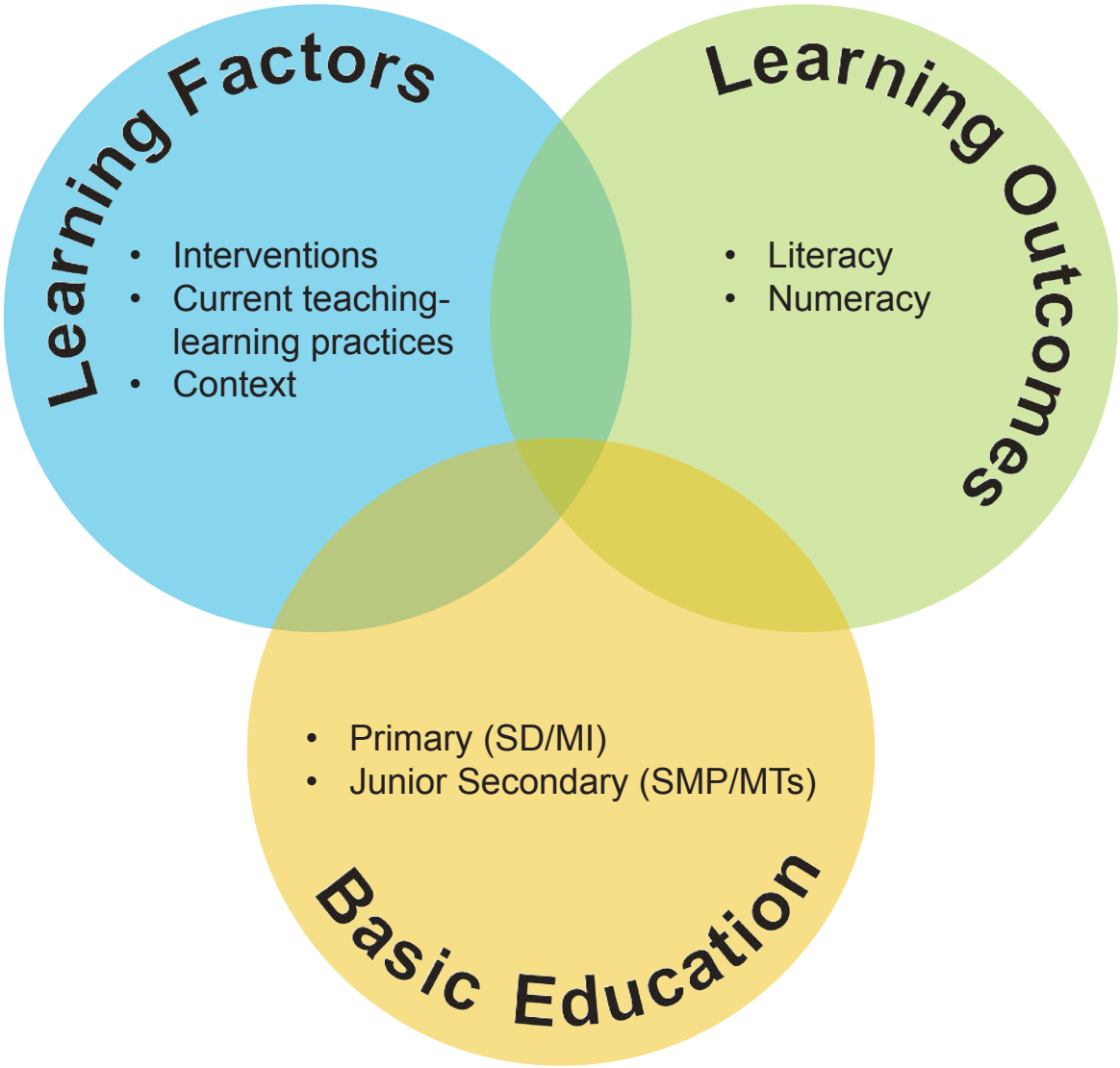
The World Bank analysis and underlying reviews largely considered studies that are experimental or quasi-experimental in nature. This means that the studies they considered either allocated interventions randomly or utilised another study design or statistical method to approximate a random allocation of a specific intervention. Meanwhile, the Hattie meta-review also incorporated studies that were observational in nature, looking at the practices and factors that influence learning outcomes more broadly rather than just the introduction of specific interventions.

Few Indonesian studies were included in the above reviews. The 11 primary studies within the reviews included in the World Bank's report that were conducted in Indonesia examined the effects of access improvement, nutritional supplementation, school governance and resources, including teacher characteristics. A review that includes a broader range of study designs – including observational studies- and specifically targets Indonesian context will be able to complement and compare those findings with the effects of classroom teaching and school practices. In addition to that, this review also included studies undertaken in specific contexts, such as low SES (Socio-Economic Status) community, children with low exposure to the Indonesian language, as well as specific ethnic groups in Indonesia. A narrative review as the supplementary analysis to the meta-analysis will explain how each intervention interact with the context.

Focus of the Review

The population of interest for this review covers students in the Indonesian formal education system at the primary and junior secondary levels. The review covers public and private schools that are overseen by MoEC, as well as public and private madrasahs (Islamic school) that are overseen by the Ministry of Religious Affairs. This sub-section discusses the definitions and any possible issues around the three key concepts for this review: learning outcomes, basic education and learning factors (illustrated in Figure 1 below). The study focuses on the overlap between these three areas, marked X in Figure 1.

Figure 1: Review Concepts



BASIC EDUCATION IN INDONESIA

Indonesia has a 6-3-3 school-based education system with six years of primary, three years of junior secondary, and three years of senior secondary (general or vocational) school. Children enter primary school at the age of 6-7 and complete high school at around the age of 18-19. In line with INOVASI's support of the GOI's 9-year compulsory basic education program, this review will focus only on studies of primary and junior secondary students.

Two Ministries oversee formal schools in Indonesia. While most schools fall under the purview of MoEC, the Ministry of Religious Affairs is responsible for the Islamic school sector. The schools in this latter sector fall mainly into two categories: madrasah, which forms part of the formal education system, and the more traditional *pesantren*, which do not. Alongside delivering most of the general curricular content set by MoEC, close to a third of the curriculum in madrasah institutions covers religious content set by MoRA. The madrasah system enrols approximately 20% of primary and junior secondary students within the formal education system (MoRA, 2013). Both the general and madrasah schools sector have public and private schools. However, around 90% of madrasah are private compared to only around 15% of schools in the general sector (MoEC, 2013; MoRA, 2013).

This review will include studies involving students in both private and public institutions in:

- Primary schools, both SD (*Sekolah Dasar*, or general primary school) and MI (*Madrasah Ibtidaiyah*, the madrasah equivalent)
- Junior secondary schools, both SMP (*Sekolah Menengah Pertama* in the general system) and MTs (*Madrasah Tsanawiyah*, the madrasah equivalent).

LEARNING FACTORS: INTERVENTIONS, PRACTICES, AND CONTEXTUAL FACTORS

As previously described, the recent meta-analyses and reviews on learning outcomes in developing countries largely focused on interventions. Those reviews mostly restricted the meta-analysis to studies of experimental (or randomised controlled trials) or quasi-experimental design. Besides focusing on Indonesia only, this review seeks to incorporate other types of study designs and along with them other types of correlates of student learning outcomes.

More specifically, the three aspects on which this review is interested in for examining their relationship with learning outcomes include interventions, practices and contextual factors. These are defined as follows:

- **Interventions**: these are programs, projects or approaches that have been purposely designed and introduced (or removed). Their scale, scope and specifications may vary. They may range from a large-scale government-led reform such as teacher certification, to a new pedagogical approach to teaching mathematics piloted in a group of schools. The studies that examine interventions are often evaluation studies, which may include experimental, quasi-experimental and non-experimental designs with and without controls.

- **Practices**: these refer to classroom, school- and community-level practices that are undertaken by the relevant actors. Practices may be influenced by interventions. Unlike interventions, however, such practices are not necessarily a direct result of an explicit policy. They also may not have a clear starting or end point. Relevant studies of teaching-learning practices are often non-experimental in design, capturing variations in observed practices and their correlation with student learning outcomes. For example, a study may collect and link data on different types of school management practices and their relationship with student learning. In another example, a household survey may be used to examine the amount of time parents spend helping their children with homework with the children's school outcomes.
- **Contextual factors**: these are factors that may directly or indirectly affect student learning but cannot be easily influenced or changed by actors in question. Many studies, for example, account for the influence of students' socio-economic background on their learning outcomes by asking about their parents' education levels or resources they have at home. This review will also collect estimates of contextual factor that correlates with learning outcomes. These can be used as a benchmark for comparing the size of effects of interventions and practices.

LEARNING OUTCOMES: LITERACY AND NUMERACY

Literacy and numeracy include the functional "three-Rs" skills of reading, writing and arithmetic (in Indonesian this is popularly known as membaca, menulis dan berhitung or calistung). Both concepts, however, also extend to broader cognitive abilities: to do abstract and logical reasoning, and interpreting a problem-solving process using these basic skills.

The literacy and numeracy skills that this review focuses on are most closely, but not strictly, linked to the subjects of mathematics and languages in the curriculum. An intervention or practice at the school- or household-level, or delivered through another curriculum subject, may also influence literacy and numeracy outcomes.

A final key concept to delineate this review's area of focus is outcomes, or more specifically, measurable literacy and numeracy outcomes. In particular, it seeks studies that can clearly define and measure the learning outcomes that such factors influence. The review was only interested in the learning outcomes that is captured by a set of objective measures. The most common way for studies to do this is by using assessments of student learning outcomes in literacy and/or numeracy.

Review questions

The aim of this review is to investigate the interventions, practices, and contextual factors that are linked to literacy and numeracy outcomes for basic education in Indonesia. More specifically, the review will seek to address the following two questions.

1. ***What are the effects of different interventions, practices and contextual factors on student learning outcomes in Indonesia?***

2. ***How do these factors interact with each other in contributing to student learning outcomes?***

Taken together, in answering the above questions, the review will describe and compare the factors that can be harnessed to improve student learning outcomes in Indonesia, as well as provide insight into the state of research for this important area.

Method

STUDY SELECTION CRITERIA

One approach to defining studies relevant to a systematic review question is to address population, intervention, control or study design, and outcomes of interest or PICO (The Joanna Briggs Institute, 2014). PICO are defined as follows:

- **Population**: the review will focus on studies involving Indonesian students in basic education (that is, Grades 1 to 9) in the formal education system (which includes primary schools or SD/MI and junior secondary schools or SMP/MTs).
- **Interventions**, practices and contextual factors: the review will include studies that examine the role of policy and program interventions, practices within the classroom, school and community, as well as home and community contextual factors that affect student learning outcomes.
- **Comparison**: This review will include experiment studies that explicitly identify control or comparison groups, as well as studies that identify the effect of differences in particular observable variables on literacy and numeracy outcomes.
- **Outcomes**: the review will include studies that link the above factors to measurable and clearly defined student learning outcomes in literacy or numeracy. In other words, the studies should assess literacy or numeracy learning outcomes in an objective manner. These outcomes were measured quantitatively, most commonly as change or differences on an assessment of literacy or numeracy skills.

Given the specifications regarding control groups and outcomes above (and definitions discussed), this review will include studies that provide measured estimates of the effects of particular interventions, practices and factors on student learning outcomes. Therefore, this will exclude studies that employ a purely qualitative study design to describe effects. A complete list of what this systematic review is about can be seen in the table below.

Table 1. What this systematic review is (not) about

Qualifier	Not about	About
Population of study	Studies that were conducted in country(s) other than Indonesia, and Indonesian sample were not included	Studies that conducted in Indonesia or present specific analysis on Indonesian sample
Level of schooling	Senior high school level (SMA or MA) and Vocational high school	Primary (SD or MI) and junior secondary school (SMP or MTs) level or grade 1 to 9
Type of schooling	Non-formal education (e.g. religious schools or pesantren that do not follow madrasah or formal school curriculum).	Formal school including madrasah, private and public schools
Learning outcomes	Studies did not measure learning outcomes, or measuring learning outcomes other than literacy and numeracy. Studies measured literacy outcomes other than Indonesian language. The learning outcomes was not measured in an objective way	Studies measured student numeracy and literacy (in Indonesian language) learning outcomes with a set of clear criteria
Information provided	Narrative reviews, discussion or opinion papers, quantitative studies with incomplete statistical report.	Studies had to provide data that are possible to be meta-analysed
Intervention, practices, and contextual factors	Studies that did not investigate the link between factors to the learning outcomes.	Studies had to investigate the link between factor(s) to the student learning outcomes.

SEARCH

The review team conducted a systematic search in August 2016. The team collected published papers, unpublished research reports, as well as 'grey' literatures from academic databases, Indonesian universities repositories (most of these are teacher training institutions), websites of international and local research institutes. The review team searched studies that are written in English and Indonesian. Several full texts of an unpublished research reports from universities were obtained directly from the universities. A total of 3,483 studies were collected, but we found many duplications[1]. The unique set of 2,693 individual studies proceeded to the screening phase. A complete list of sources searched as well as the search strings and number of studies found for each search is presented in the Appendix 2.

[1] Same studies appeared in more than one database.

ABSTRACT AND FULL TEXT SCREENING

The screening process was done in two stages. The first stage was title and abstract screening where the studies were included if the abstracts met all of the following criteria:

- The study was done in Indonesia
- The participants were elementary and/or junior secondary students
- The study assessed students' literacy and numeracy outcomes

All studies were double screened using Covidence Systematic Review Software (Veritas Health Innovation, Ltd.). All disagreements were coded as conflicted studies and were assigned to a third reviewer. As a result of the abstract screening, 233 studies were selected to be carried forward to full-text screening.

The double screening method was also employed in the full-text screening. In this stage, the reviewers looked more into the detail of the study full-texts and included them if the study:

- examined the relationship between any factors and student's literacy and numeracy learning outcomes in a quantitative manner, and
- assessed students' learning outcomes in an objective manner.

This process resulted in 120 included studies to be extracted.

IN-DEPTH REVIEW

The in-depth review stage moved from a broad characterisation or mapping of the included studies, to making detailed descriptions and extracting the relevant evidence within the studies. In this stage, findings reported by each of the studies were double coded using EPPI Reviewer 4 (Thomas, Brunton, & Graziosi, 2010). In this stage, reviewers extracted statistical outcomes reported in the paper for further analysis. This process also included quality appraisals of each of the study as the basis for further cut-off of the low-quality studies. All extracted data were categorised into factors that contribute to students' achievements as suggested by Hattie (2009), as follows:

- **Home**, e.g. parents' education, support from parents, language spoken at home, resources available at home, household wealth
- **School**, e.g. student-teacher ratio, facilities or resources at school, school budget, school community size, language of instruction
- **Curricula**, e.g. type of curricula, subject hours, use of standardised national or regional assessment
- **Teacher**, e.g. qualifications, experience, gender, professional development undertaken, absence rate, job satisfaction
- **Teaching**, e.g. lesson plan, provision of feedback, degree of interaction with students during lessons, collaboration with other teachers, strategy or approach
- **Student**, e.g. gender, age, health condition, attitude, motivation, time spent on reading or sports or other activities, participation in tutorial classes

Given the lack of findings related to curricula, this category was excluded from further analysis. The final component for this stage was the quantitative synthesis of these collected evidence using DerSimonian & Laird's (2007) random effect model of meta-analysis to answer the first question of the review.

A limitation of a standalone meta-analysis tends to be that it is unable to explore the mechanisms behind the relationship between inputs and outcomes (Evans & Popova, 2015). To give a deeper and more comprehensive picture of what was behind the relationship between the factors and student learning outcomes, this review also extracted qualitative information for supplementary analysis. The information was coded based on the following questions:

- Have disadvantaged groups been excluded from the study (such as students with learning difficulties, living in remote areas, coming from low SES family etc.)?
- Did the study focus on disadvantaged groups such as special needs children, lower socio-economic background, different ethnic backgrounds? What are the characteristics of the study population? Can the intervention be adapted to the population without disadvantages?

ASSESSING QUALITY OF STUDIES

As discussed above, the quality of each study was doubly assessed by the review team. The criteria for the assessment are adapted from the Cochrane Risk of Bias Assessment tools (Higgins & Green, 2011). The quality assessment tools were modified into two sets of forms to accommodate the nature given by two distinct research methods; observational and experimental studies.

For experimental studies, the reviewers assessed whether the study has a high, low, or unclear risk of bias. The different types of bias are listed below:

- **Selection bias:**
  Assessing whether there is potential bias due to the sampling method employed in the study and whether the intervention allocations could have been foreseen before or during the enrolment.
- **Attrition bias:**
  Detecting if there is any risk of bias due to the withdrawal during the experiment process or exclusions of observations from the analysis.
- **Reporting bias:**
  Looking whether the author only reported selected outcomes and the absence of the unreported variable could lead to the higher risk of bias.
- **Omitted variable bias:**
  The low risk study is the one that identified confounding factors and used strategies to deal with them, e.g. with the use of covariates
- **Measurement bias**
  To minimise the bias given by the instrument that assessed literacy and numeracy outcomes, reliability and validity of instruments to measure student learning outcomes should be tested and described

- **Performance and detection bias**

  Detecting the risk of bias of the measured outcomes due to whether the outcomes assessors know which students who are assigned to treatment or control group.

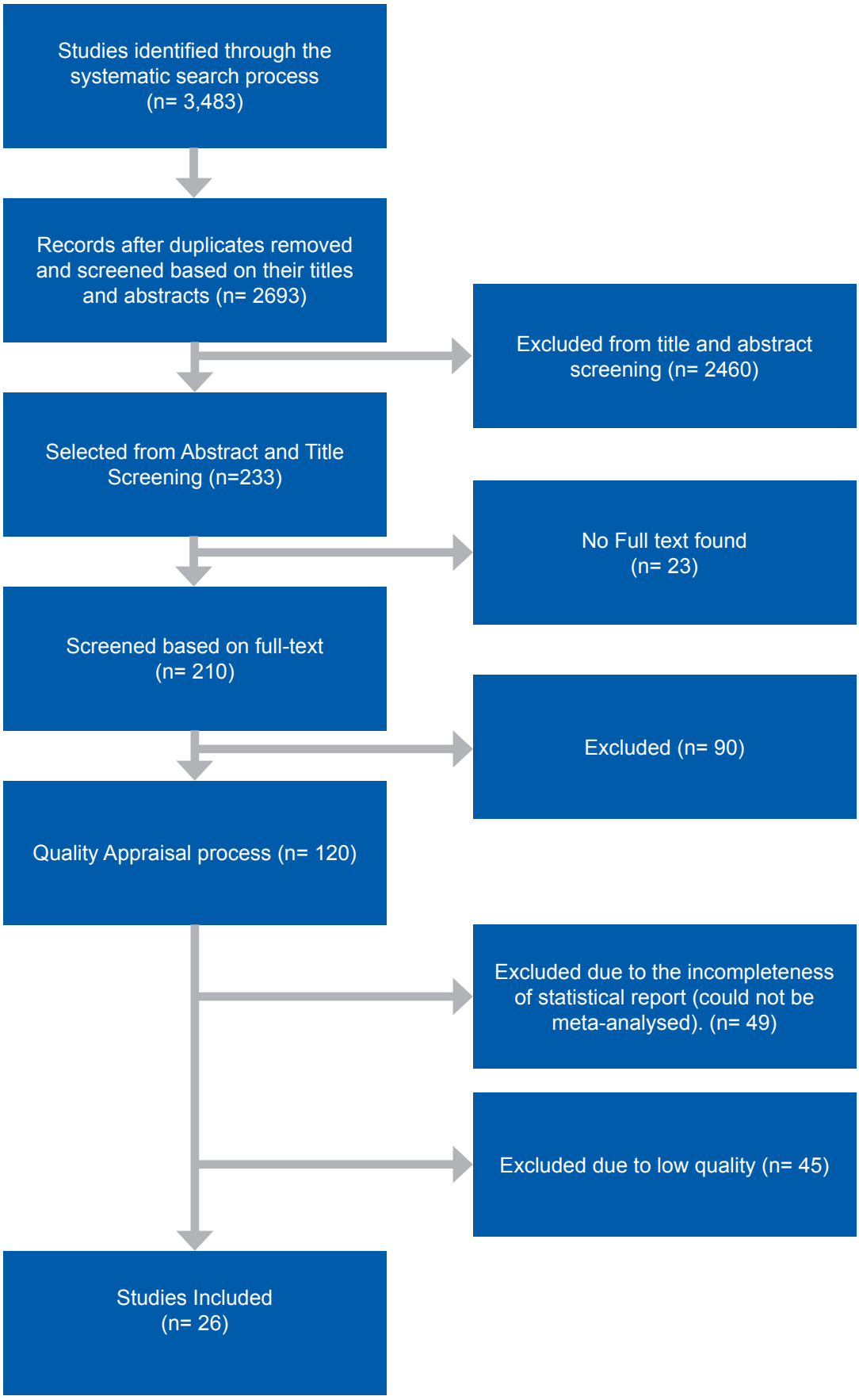
In addition to the adapted Cochrane risk of bias form above, we also assessed whether the studies used a particular calculation to justify the sample size needed or presented the error margins (e.g. standard error, standard deviation, confidence interval) alongside the estimates.

For the observational studies, several dimensions such as concealment of allocation under selection bias, attrition bias, as well as performance and detection bias were included in the form.

To summarize these quality criteria into an overall quality indicator for each of the study, the reviewers put weight on each dimension based on how strong the bias was for a particular dimension and by how far it would affect the accuracy of the estimation. Studies with high risk of bias due to selection process methods, omission of confounding variables in the analysis, or low validity and reliability of the outcomes' measurements were considered to be low quality studies. If the study has a high risk of bias in at least one of the other criteria, that study was judged as a medium quality study. The high quality studies were those with low risk of bias in all dimensions assessed in the form. The overall judgements of the included studies is presented in the Appendix 5.

In addition to the assessment based on the risk of bias assessment tools, we also assessed whether the statistical report presented in the data are sufficient to be meta-analysed. Findings from 120 individual studies were collected. However only 71 studies that reported 150 findings could be meta-analysed. The rest do not report sufficient information. From the 71 studies, only nine of them considered as high quality studies, while about 45 studies are considered to be low quality. To reduce the risk of bias that this systematic review findings could have, the low quality studies were excluded from the review. The detail explanation about the data found in the low quality studies is explained in the result section.

Figure 2. Systematic map; searching, screening, and quality appraisal



Results

The result of the synthesis will be presented in two sections. This first section compares the magnitude of effects given by student, home, teacher, teaching, and school factors to the increase of literacy and numeracy outcomes as well as highlighted particular specific factors or interventions that has a remarkable effect in each category. We found that teaching is the area that contributed most to the learning outcomes. The second part explores the mechanism behind the positive or negative effects of the teaching category. For example, good teaching practice is dependent on the teachers' pedagogical skill as well as subject proficiency. However, it is important to keep in mind that this review only considered practices and interventions that have been evaluated in Indonesia, which are not exactly representing the complete picture of Indonesian education.

META-ANALYSIS

Each of the findings from all included studies was converted into Cohen's effect size (d), or standardised mean difference (see the basic formula below).

$$d = \frac{\overline{X_t} - \overline{X_c}}{SD_c}$$

$\overline{X_t}$ and $\overline{X_c}$ are mean of post-test score in treatment and control group, respectively. The score difference is divided by standard deviation of the control group (Please see the detail formula used to convert various types of outcomes in Appendix 6).

Standardising the outcomes into effect sizes enable us to have same standard to interpret findings from different studies (Lipsey & Wilson, 2001). We interpret the effect size based on Cohen's Effect Size Index (Cohen, 1992).

Table 2. Cohen's Effect Size Index

Effect Size	Interpretation
-0.19 to 0.19	No effect
0.2 to 0.49 or (-0.2) to (-0.49)	Small effect
to 0.79 or (-0.5) to (-0.79)	Medium effect
> 0.8 or <(-0.8)	Large effect

To accommodate inter-study variance in terms of methods, interventions, measurements, and estimation types, the effect sizes were pooled using DerSimonian Laird random-effect model for meta-analysis (Dersimonian & Kacker, 2007).

In the meta-analysis, we pooled the effects based on (1) quality of the studies, (2) type of interventions, (3) demographic factors that linked with student learning outcomes. The results are presented in the following sections.

Meta-analysis by the quality of the studies

Based on the quality appraisal process, we only found 9 studies, reporting 21 findings, that were considered as high quality studies or having low risk of bias on all the dimensions assessed. The majority of the studies were considered to have low quality (45 studies reporting 74 findings) while 16 studies reporting 54 findings were appraised as medium quality studies. By only looking at high quality studies, we found that number of findings per category is very limited as can be seen in the table below.

Table 3. High quality findings

Intervention Category	N of Findings	Source/ Independent Variable	Direction of effect
Home	1	a. Ali et al (2011)/ Home background factor (parental education background and number of resources	a. Positive
School	8	a. Ali et al (2011)/ Number of school resources b. Suryadarma et al (2006)/ proportion of permanent teacher c. Pradhan et al. (2011)/ collaboration school committee & village council – numeracy d. Pradhan et al. (2011)/ collaboration school committee & village council – literacy e. Pradhan et al. (2011)/ Democratic election of school committee f. Suryadarma et al (2006)/ School using Indonesian g. Suryadarma et al (2006)/ Student-teacher ratio h. Suryadarma et al (2006)/ school using language that different from mother tongue of the majority of students	a. Positive b. Negative c. Positive d. Positive e. Positive f. Positive g. Negative h. Negative
Student	5	a. Suryadarma (2015)/ gender (girls > boys) b. Sudijono et al (2014)/ Self-efficacy c. Ali et al (2011)/ age d. Ali (2011)- students' expectation on education e. Ali (2011)- Negative attitude toward school	a. Positive b. Positive c. Negative d. Positive e. Negative
Teacher	4	a. De Ree et al (2015)/ teacher certification - numeracy b. De Ree et al (2015)/ teacher certification - literacy c. Trorsenburg et al (2015)/ Teachers' subject and pedagogical competence -numeracy d. Trorsenburg et al (2015)/ Teachers' subject and pedagogical competence – literacy	a. No effect b. No effect c. Positive d. Positive
Teaching	3	a. Iqram (2014)/ Collborative and problem-based learning b. In'am (2013)/ Formula for understanding number sequence c. Sudijono (2014)/ Mind mapping	a. Positive b. Positive c. Positive
Total	**21**	**9 studies**	

The outcomes of this quality assessment is consistent with a previous review conducted by Evans and Popova (2015) where only 11 studies from Indonesia are sufficiently rigorous to be included in their review. Table 4.2. and 4.3 below summarise the effect size for numeracy and literacy, respectively, from high quality studies. If all high quality findings are combined into one pooled effect size, we can found that there is a high overall effect to the numeracy (d=0.901)[2] but no effect to the literacy (d= 0.097)[3] learning outcomes (see Table 2). The forest plot of the effect sizes is presented in the appendix 7.

Table 4. Overall effect size for numeracy from high quality studies

Study	Effect	[95% Conf.	Interval]	% Weight
Percentage of permanent teacher	-1.762	-1.801	-1.722	8.37
Negative attitude toward school	-0.436	-0.438	-0.435	8.38
Age	-1.876	-12.013	8.261	0.19
Collaborative & problem-based	0.743	0.543	0.942	8.24
committee and village apparatus collaboration	0.334	0.317	0.35	8.38
Competence	1.387	1.311	1.464	8.36
expected education level	4.129	3.901	4.358	8.2
Gender	0.708	0.698	0.719	8.38
mind mapping	0.64	0.563	0.718	8.36
Number of school resources	0.505	0.439	0.571	8.36
self-efficacy	0.627	0.4	0.854	8.2
Changing strategy based on students' needs	1.888	1.662	2.115	8.2
use Indonesian language of instructions	2.188	2.113	2.263	8.36
Overall effect (dl)[1]	**0.901**	**0.451**	**1.351**	**100**

Table 5. Overall effect size for literacy from high quality studies

Study	Effect	[95% Conf.	Interval]	% Weight
Collaborative &problem-based	0.448	0.43	0.465	20
Competence	0.345	0.319	0.371	20
Democratic	1.05	1.019	1.081	19.99
diff mother tongue	-0.693	-0.702	-0.683	20
Student : teacher ratio	-0.666	-0.676	-0.657	20
Overall effect (dl)	**0.097**	**-0.452**	**0.645**	**100**

The above table shows how limited the information is that can be drawn from this meta-analysis. By only including the nine high qualified studies in this meta-analysis, this review would not be able to draw a comprehensive comparison of a wide range of factors that contribute to numeracy and literacy learning outcomes.

[2] The overall effect was significant (at 95% confidence interval) with variance of 0.651

[3] The overall effect was not significant (at 95% confidence interval) with variance of 0.391

To map how factors from all the included studies contribute to learning outcomes, we then need to consider all findings that linked to literacy and numeracy outcomes regardless of the quality of the studies. The mean of weighted effect size for factors that contribute to numeracy outcomes is 0.717 with a variance of 0.152 and the overall heterogeneity (Q) value is 5600000 (df= 79, p= 0.00) which indicates a lot of variation in the study. Similarly, the pooled effect size for literacy outcomes is 0.563 with a variance of 0.218 and overall heterogeneity value is 7800000 (df = 73, p= 0.00). The table and forest plots that illustrate the effect size can be found in the Appendix 8.

From the low quality studies, there are several promising interventions that had a large effect size such as giving iron supplement to anaemic students (d= 2.97, v= 0.147), discovery learning teaching method (d= 3.91, v= 0.1818), using media boards as inspiration for students in writing lesson (d= 3.51, v= 0.17), and students' ability to regulate themselves in learning (d= 2.4, v= 0.34). However, it is too risky to include these studies due to their poor methodology. The studies above, for example, did not use a rigourous method in recruiting their participants. Most of the low quality studies also tested their interventions on very small samples, as low as 20 to 30 participants, and did not use a control group for comparison.

If we summarise the weighted effect sizes of high and medium qualities altogether for numeracy outcomes, we can have a medium pooled effect size (d= 0.592)[4]. For numeracy outcomes, the pooled weighted effect size is small (d= 0.214)[5].

To find a balance between meeting the review purpose and presenting the results with minimum risk of bias, this review only includes studies with high and medium quality in the further analysis. In addition to that, several medium quality studies with large standard errors were considered as outliers and eliminated from the further analysis. The eliminated studies are Rosida (2016), Nurhayati & Wimbarti (2013), Rostika, Windayana, & Komariah (2016) and Habibah & Wimbarti (2003).

Meta-analysis by type of intervention

Student Effect

In this category, we grouped independent variables related to the child or aspects that the child brings to their learning process. In this category, we only include factors that can suggest possible areas of improvement, for example, attitude, aspiration, or ability to think logically. The overall pooled effect size of these factors is 0.486 with a value of variance 0.18. However, there are several factors that have a large effect size (d> 0.8), such as students' expectation on their education attainment (d= 4.129, v= 0.12) and motivation (d= 0.827, v= 0.02). Table 4 below illustrates the effects of student factors on numeracy outcomes.

[4] The variance is 0.151 and heterogeneity value is 5600000 (df= 48, p= 0.00)

[5] The variance is 0.218 and heterogeneity value is 7700000 (df= 30, p= 0.00).

Table 6. Student effect to numeracy outcome

Study	Effect	[95% Conf.	Interval]	% Weight	Quality
negative attitude toward school	-0.436	-0.438	-0.435	8.57	High
Negative attitude toward Indonesian lesson	-0.264	-0.292	-0.236	8.56	medium
Attendance	0.161	0.16	0.162	8.57	medium
expected education level	4.129	3.901	4.358	7.97	High
Girls > boys	0.708	0.698	0.719	8.57	High
Time spent on learning at home	0.06	0.014	0.106	8.54	medium
logical thinking	0.1	0.054	0.147	8.54	medium
Motivation	0.827	0.791	0.862	8.55	medium
self-directed	0.06	0.014	0.106	8.54	medium
self-efficacy	0.627	0.4	0.854	7.97	High
spatial ability	0.453	0.067	0.839	7.05	medium
Perception on study obstacles	-0.34	-0.369	-0.311	8.56	medium
Overall effect (dl)	**0.486**	**0.243**	**0.729**	**100**	

The meta-analysis shows that these factors have no statistically significant effects on literacy outcomes (d= -0.255, v= 0,312). The table below illustrates that there is no individual factor that has an effect higher than 0.8. There is a medium negative effect for gender (d= -0.651, v= 0.00), while the other factors only contribute small or no effect.

Table 7. Student effect to literacy outome

Study	Effect	[95% Conf.	Interval]	% Weight	Quality
Positive attitude toward Indonesian lesson	-0.202	-0.229	-0.174	20	medium
Negative attitude toward school	-0.228	-0.256	-0.201	20	medium
Boys < girls	-0.651	-0.652	-0.65	20.01	medium
Attendance	0.141	0.14	0.141	20.01	medium
Perception on study obstacles	-0.334	-0.362	-0.305	19.99	medium
Overall effect (dl)	**-0.255**	**-0.744**	**0.235**	**100**	

The findings for student effects are in line with John Hattie's (2009) conclusions that developmental effects only contribute 0 to 0.15 standard deviation to the learning outcomes.

Teacher Effect

An overall medium effect (d= 0.582, v= 0.252) is contributed by the pooled teacher factors to the numeracy learning outcomes. The teacher category consists of measures such as their experience in teaching, employment status, payment scheme received and competence. Among the synthesized factors, the highest influence is demonstrated by teachers' subject and pedagogical competence (d= 1.39, v= 0.04), whereas the other factors only provide a small or no effect. This is summarised in the table below:

Table 8. Teacher effect to numeracy outcomes

Study	Effect	[95% Conf.	Interval]	% Weight	Quality
years in teaching	0.12	0.12	0.121	33.43	medium
Competence	1.387	1.311	1.464	33.23	High
Certification	0.243	0.192	0.294	33.34	medium
Overall effect (dl)	**0.582**	**0.014**	**1.151**	**100**	

A very small effect is observed in the meta-analysis for teacher factors of literacy outcomes (d= 0.175, v= 0.002). Similar to numeracy outcomes, teachers' subject and pedagogical competence provides by far the highest effect on literacy outcomes (d= 0.345, v= 0.01). However, according to Cohen's (1992) barometer, this effect is still considered to be small.

Table 9. Teacher effect to literacy

Study	Effect	[95% Conf.	Interval]	% Weight	Quality
Certification	0.121	0.08	0.162	32.71	medium
Competence	0.345	0.319	0.371	33.41	High
years in teaching	0.161	0.16	0.162	33.88	medium
Overall effect (dl)	**0.209**	**0.083**	**0.336**	**100**	

Teaching Effect

This meta-analysis synthesizes the effects of various teaching strategies used in the classroom, such as use of formative assessment, collaborative learning, problem-based learning, or a combination between several types of strategies. A large effect of this intervention is shown in the meta-analysis both for numeracy (d= 1.319, v= 0.305) and literacy (v= 0.931, d= 0.448)

Interventions that showed distinctly high effects for numeracy learning outcome are formulas for understanding numerical sequences (teaching formula) (d=1.89, v= 0.12) and hypno-teaching (d=5.376, v= 0.32). The summary can be seen in the table below.

Table 10. Teaching effect to numeracy

Study	Effect	[95% Conf.	Interval]	% Weight	Quality
peer-tutoring	0.206	0.087	0.326	12.93	medium
formative assessment	1.358	1.326	1.39	13.08	medium
computation strategy	0.649	0.511	0.786	12.88	medium
mind mapping	0.64	0.563	0.718	13.02	high
information mapping	0.675	0.612	0.737	13.05	medium
Hypno teaching	5.376	4.752	5.999	9.83	medium
Collaborative & problem-based	0.743	0.543	0.942	12.66	high
Using learning media	1.888	1.662	2.115	12.54	high
Overall effect (dl)	**1.319**	**0.927**	**1.71**	**100**	

For literacy learning outcomes, interventions that showed a large effect are using serial pictures to help children compose a passage (d= 2.412, v= 0.12) and intensive reading to help students comprehend texts (d= 0.865, v= 0.15). Beside these two strategies, most of the synthesised strategies have a medium effect on literacy outcomes. The teaching strategies and their effects can be seen in the table below.

Table 11. Teaching effect to literacy outcomes

Study	Effect	[95% Conf.	Interval]	% Weight	Quality
intensive reading	0.865	0.564	1.167	19.43	Medium
talking stick game	0.452	0.337	0.567	20.3	Medium
SQ3R (Survey, Question, Read, Recite, Review)	0.405	0.241	0.568	20.14	Medium
Collage	0.547	0.415	0.678	20.25	Medium
serial pictures	2.412	2.187	2.638	19.87	Medium
Overall effect (dl)	**0.931**	**0.338**	**1.525**	**100**	

School Effect

School effects comprise factors that relate to school policy and resources. The random effect meta-analysis model for school factors to numeracy outcomes shows an insignificant or no effect of the overall factors. However, looking at the effect of individual studies, we found a large negative and positive effects, such as a large proportion of permanent teachers have a negative impact (d= -1.762, v= 0.02), whereas large positive effects were contributed by the use of Indonesian language in schools (2.188, v= 0.04) and principal preparedness to implement school-based management (d= 2.762, v= 0.01). Individual school effects from each of the studies are illustrated in the table below.

Table 12. School effect on numeracy outcomes

Study	Effect	[95% Conf.	Interval]	% Weight	Quality
principal preparedness	2.762	2.743	2.782	25	Medium
Committee and village apparatus collaboration	0.334	0.317	0.35	25	High
percentage of permanent teacher	-1.762	-1.801	-1.722	25	High
use Indonesian	2.188	2.113	2.263	24.99	High
Overall effect (dl)	**0.88**	**-0.96**	**2.721**	**100**	

Likewise, the meta-analysis reported the overall school factors had an insignificant effect on students' literacy learning outcomes (d= 0.102, v= 0.464). Only one factor had a large positive effect on the literacy outcomes, which is school policy to elect school committee in a democratic manner (d= 1.5, v=0.02). The rest of the studies show medium negative effects and small positive effects. The effects are presented in the table below.

Table 13. School effect on literacy outcomes

Study	Effect	[95% Conf.	Interval]	% Weight	Quality
principal preparedness	0.37	0.369	0.371	20	medium
Democratic	1.05	1.019	1.081	19.99	High
Committee and village apparatus collaboration	0.448	0.43	0.465	20	High
Language of instruction different from mother tongue	-0.693	-0.702	-0.683	20	High
Student : teacher ratio	-0.666	-0.676	-0.657	20	High
Overall effect (dl)	**0.102**	**-0.495**	**0.699**	**100**	

Home Effect

This category comprises several independent variables that relate to the home environment and family life. In this category, we only focus on factors that can possibly be interfered with or factors that provide scopes for improvements. Other factors related to home environment that are more static, for example parent educational background or ethnicity background, will be discussed in the next category.

Home factors have significant but small effects on both literacy (d= 0.322, v= 0.017) and numeracy outcomes (d= 0.463, v= 0.039). Looking at the individual studies, only one variable had a large effect on literacy; the duration of reading activities done by students at home (d= 0.84, v= 0.02). On the other hand, all individual variables under home factors only had small effects on numeracy outcomes. Tables that summarize the effect of home factors are presented below.

Table 14. Home effect to numeracy outcomes

Study	Effect	[95% Conf.	Interval]	% Weight	Quality
number of family members who helped	0.43	0.399	0.46	33.37	Medium
Number of family members who encouraged	0.372	0.343	0.402	33.4	Medium
parent involvement	0.165	0.129	0.2	33.22	Medium
Overall effect (dl)	**0.322**	**0.173**	**0.471**	**100**	

Table 15. Home effect to literacy outcomes

Study	Effect	[95% Conf.	Interval]	% Weight	Quality
Number of family members who helped	0.331	0.302	0.36	25.04	Medium
Number of family members who encouraged	0.327	0.298	0.356	25.04	Medium
reading activity	0.84	0.797	0.884	24.87	Medium
reading facility	0.355	0.326	0.384	25.04	Medium
Overall effect (dl)	**0.463**	**0.269**	**0.657**	**100**	

Demographic findings

This category covers variables that do not provide room for improvements and needs to be considered as they are. Listed in this category, for example, are region of domicile, family education and SES background, students' age, and resources owned by the household or school. For numeracy outcomes, the pooled factors had a small effect size (d= 0.443, v= 0.24). Meanwhile, the meta-analysis found that there is no effect of the pooled variable on literacy (d= -0.092, v= 0.414). The summary of effects can be seen in the tables below.

Table 16. Other factors linked to numeracy outcomes

Study	Effect	[95% Conf.	Interval]	% Weight	Quality
Age	-1.876	-12.013	8.261	0.13	High
International-equivalent curriculum	0.73	0.729	0.731	13.32	Medium
home background	1.336	0.329	2.343	6.68	Medium
Kalimantan vs Java	-0.349	-0.349	-0.348	13.32	Medium
number of people in home	0.403	0.373	0.433	13.31	Medium
number of school resources	0.505	0.439	0.571	13.27	High
Papua vs Java	-0.482	-0.483	-0.481	13.32	Medium
Religion	-0.331	-0.36	-0.302	13.31	Medium
Sulawesi vs Java	-0.482	-0.483	-0.481	13.32	Medium
Overall effect (dl)	**0.086**	**-0.283**	**0.454**	**100**	

Table 17. Other factors linked to literacy outcomes

Study	Effect	[95% Conf.	Interval]	% Weight	Quality
age	0.295	0.267	0.324	14.28	Medium
Bali vs Java	-0.843	-0.844	-0.842	14.29	Medium
Maluku vs Java	-0.935	-0.937	-0.934	14.29	Medium
parent education	0.459	0.458	0.46	14.29	Medium
Sulawesi vs Java	-0.37	-0.371	-0.369	14.29	Medium
n people in home	0.355	0.326	0.384	14.28	Medium
possession	0.394	0.364	0.424	14.28	Medium
Overall effect (dl)	**-0.092**	**-0.569**	**0.384**	**100**	

Discussion

WHAT WORKS TO IMPROVE STUDENTS' LITERACY AND NUMERACY OUTCOMES?

Comparing pooled effect sizes between types of interventions, we can see that teaching and school factors have the highest pooled effect on both literacy and numeracy learning outcomes. Under school factors, principal preparedness to implement school-based management contributed the highest to numeracy learning outcomes. A good school management is determined by a principal who can provide supervision to the school staffs and have a clear plan in terms of academic improvement and school finances. These principals are also capable of supervising and evaluating teachers' performance (Vernez, Karam, & Marshall, 2012)

Findings from the study by Suryadarma, Suryahadi, Sumarto, and Rogers (2006), show that having a higher proportion of permanent or civil servant teachers have a large negative impact on students' math scores. This finding may indicate that secure position lowers teacher productivity in comparison to non-permanent teachers who need to maintain their performance to secure their jobs. The school level measure school committee democratic elections have been found to also have a large impact on learning outcomes. A study conducted by Pradhan et al. (2014) explained that the reform of school policy related to school committee organisations improve community engagement to support learning. To summarise, findings from school factors reveal that the principals' leadership skills, including how they boost teachers' performance and community engagement, positively impact learning outcomes.

Let us now take a look at the broader implications for the variables under teacher and home categories that contribute largely to the learning outcomes. Most home factors have a small effect on student learning outcomes. Looking into the individual variables, factors that influence both numeracy and literacy learning outcomes is support from family in a form of encouragement and help. Specific to the literacy outcomes, the possession of books and how often students read at home contribute largely to their literacy outcomes (Johnstone, 1983). A study conducted by van Bergen, van Zuijen, Bishop, and de Jong (2016), that also found a relationship between access to books and literacy ability, explained that a number of books possessed by a family indicates the value placed on literacy. Furthermore, this study found a strong correlation between a number of book possessed and children's literacy level even when variables such as parents' reading fluency and environmental factors had been controlled.

Turning now to the teacher effect, the current meta-analysis found that experience and double-payment-scheme for teachers did not have any effect on their students' learning outcomes. Teacher competence, as assessed using a set of tests that covered mathematics, science, Indonesian language, pedagogical knowledge, and social competencies (van Trotsenburg et al., 2015), had a huge effect on numeracy outcomes but only a small effect on literacy. This finding is in line with what Hattie emphasised in his synthesis of meta-analyses that teacher is the most powerful factor in learning due to their content knowledge, social competencies, and teaching skills (Hattie, 2009).

However, the limitations of the studies included in our review is that they only suggest positive relations between teachers' content and pedagogical knowledge to students' learning outcomes without knowing exactly whether the teachers have already used their knowledge and pedagogical skills according to students' needs or classroom context (Depaepe, Verschaffel, & Kelchtermans, 2013).

With regards to the student's effect on learning outcomes, the pooled meta-analysis showed a small effect of the mean of weighted effect size under student's category on literacy (d= -0.255) and medium effect on numeracy learning outcomes (0.486). These findings are similar to observations made by Hattie (2009) that what children bring at the start of their schooling is critical to their later achievement. Looking into each finding in this meta-analysis, we can see that motivation and aspiration or expectation of highest education level that they plan to pursue has the highest effect on numeracy outcomes. In their review, Miller & Brickman (2004) explained the mechanism behind the impact that motivation and aspiration have on learning outcomes. A clear aspiration or target goal serves three functions in student learning: (i) define immediate performance that the child hope to produce, (ii) give the child signal or awareness on what aspects of learning performance they should focus on and regulate, and (iii) provide the child standards to be used to evaluate their own performance. These three aspects can be the source for drive for students to learn and regulate themselves (Miller & Brickman, 2004). Reviews suggest that these personal factors are influenced by both genetics and nurture factors from experience, knowledge, and value that the children gained from home environment or during pre-school (Hattie, 2009; Miller & Brickman, 2004). However, such factors can also be shaped by teachers, schools, or policies. This is exemplified in the recent review undertaken by Snilstveit et al. (2016) that students' motivation to learn can be effectively induced by giving a merit-based scholarship to students in the countries with low to medium income.

If the goal of education is to equip students with basic skills that can be partially translated into learning outcomes, providing interventions that focus on students' personal characteristic (e.g., motivation, aspiration, self-regulated learning, etc.) may not translate into academic learning gains if the children are still poorly taught at schools (Evans & Popova, 2015). In line with what earlier reviews suggested (e.g. Evans & Popova, 2015; Hattie, Biggs, & Purdie, 1996; Hattie, 2009), the current study also found that amongst the categories of variables, teaching category has the highest pooled effect size on learning outcomes for both numeracy and literacy. However, many studies that fall into this category suffer from methodological issues.

Other interesting findings under teaching category are how teacher use formative assessment to give themselves as well as the students feedback on the learning progress and using learning media to introduce new concepts in math. These two variables are supported by Evans and Popova (2015) who found in their review that teacher-led methods, such as formative assessment and targeted instruction, had a large effect on students' learning outcomes in the low and middle-income country. Our review also found that inquiries help children to understand reading, while making collage from series of pictures or texts help students to compose a writing. Nevertheless, we need to keep in mind that the teaching strategies investigated in the current review are mostly coming from classroom action research reports where the interventions were designed based on problem identification

undertaken by the teachers. Considering the methods employed in these studies, a likely explanation of the positive effects of teaching strategies is they were tailored to students' needs, abilities and problems. Snilstveit and colleagues' (2015) review also suggest that the provided materials will not have the desired impact if it is not tailored to students' needs and ability.

INTERVENTION, PRACTICES, AND CONTEXTUAL FACTORS

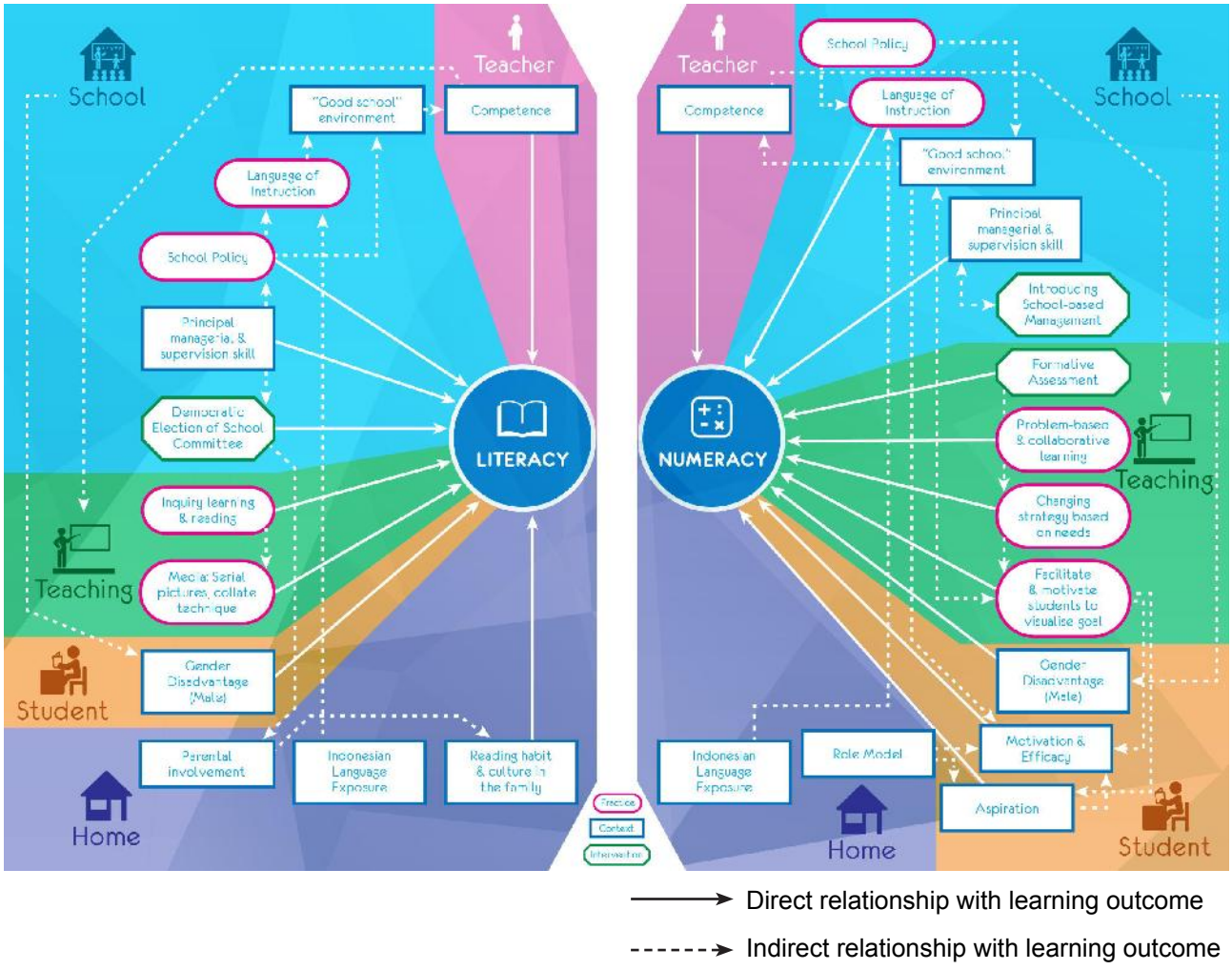
The recent meta-analyses on the quality of education in developing countries largely focus on impact evaluations of intervention or policy reforms (e.g. Asim et al., 2015; Evans & Popova, 2015; Masino & Niño-Zarazúa, 2015)at least six systematic reviews or meta-analyses have examined the interventions that improve learning outcomes in low- and middle-income countries. However, these reviews have sometimes reached starkly different conclusions: reviews, in turn, recommend information technology, interventions that provide information about school quality, or even basic infrastructure (such as desks. The current review aims to see the linkage between interventions, practices, and contextual factors.

Looking at medium and large effects in each category of independent factors, there are several factors that can be considered as interventions, such as introduction of formative assessment for teachers, language of instruction policy, policy reform in school committee democratic election for boosting parental involvement in students' learning, and the usage of international-equivalent curriculum. Some factors that fall under teaching categories were evidence from practices that are reported by teachers as their classroom action research. Under practice category, we can list several activities that have been done by the teacher, for example changing the strategy of delivering materials or illustrating the concepts using media. A problem-based approach to learning that is done in a collaborative way or how the students' family members help and encourage them at home are also considered to be practices that support students' learning process. Under contextual factor, we listed things that students bring to the school for instance, motivation, self-efficacy, and aspiration as well as their teachers' competency in terms of the subject they teach and their pedagogical knowledge. We also found students having particular demographic characteristics have lower learning outcomes for example, males in comparison with females, students living in Bali and Maluku in comparison with those who live in Java, and students who come from less educated parents in comparison with those who come from highly educated families.

If we look deeper into the mechanism behind each of the effect, the three categories (interventions, practices, and contextual factors) actually overlap. For example, the meta-analysis shows a significant and large effect on teachers' competence on learning outcomes. Looking deeper into the mechanism behind this effect, Trotsenburg et al. (2015) highlighted that the top 10% teachers are concentrated only in a few particular school that then we can consider those as the "good schools". This fact leads us to a question whether there is a particular system or intervention being employed by the "good schools" that create a motivating atmosphere for the teachers to grow or there are particular contexts attached to the "good schools" that facilitate teacher to grow. Another example is how some students can have more motivation and better learning outcomes than others (Husaini & Wirawan, 1998). In Husaini and Wirawan's study, we can see the same patterns as teachers' competence

where “good students” concentrated in the “good schools”. The study reported by Kasmaja (2016) suggested that particular classroom practices and interventions can increase students’ motivation. On the other hand, role models that the students have in their home environment are also highly correlated with their aspiration and motivation (Suryadi, 1992) libraries and library books, and other learning equipment. School management and teacher performance have also been emphasized. The need to improve the quality of primary education was reaffirmed in 1986 and is included in the Fifth Five-Year Development Plan. The aim of this study was to produce information and policy recommendations on how to improve primary schools. This study examined communities and schools to estimate primary school attendance, identify factors that influence participation, measure sixth-grade achievement, gauge the progress in different provinces, rank schools by achievement, and identify factors responsible for differential achievement in schools. Four major research questions were posed in this study: (1. These findings are also in line with numerous studies undertaken in other developing countries. A synthesis of reviews conducted by Evans and Popova (2015) also highlighted that the same intervention may provide different results depending on effectiveness of implementation across different contexts. The interaction between interventions, practices, and contextual factors is summarised in the picture below.

Figure 3. Summary of interaction among interventions, practices, and contextual factors



QUALITY OF EDUCATION RESEARCH IN INDONESIA

This review not only mapped interventions, practices, and other factors that positively and negatively linked to students' learning outcomes, but also maps the quality of the studies that were obtained from a systematic search. Only nine studies identified from the depository of all screened studies did not suffer from methodological issues. The most common problem found in the studies is bias due to incomplete reporting (55%), such as unreported variables, and unclear or incomplete estimation or statistical report. The other common source of bias is that the author did not identify or try to tackle possible confounding factors that might contaminate the result (52%).

Even though studies with low qualities were eliminated from the analysis, some medium quality studies were taken into account although they suffer from issues in terms of the rigorousness of selecting the counterfactual comparison in the experiment. Several studies employed a before-after without control design or only measured the outcomes in treated and control groups after the intervention was complete, without prior knowledge of groups being balanced before the treatment. With regards to the limitations of the individual primary studies, the findings therefore, must be interpreted with caution.

The scarcity of high-quality educational research in Indonesia was also reported by a study that incorporate six systematic reviews in developing countries (Evans and Popova, 2016). The current review strongly suggests that further in-depth studies on learning quality should be undertaken in Indonesia. Moreover, only quantitative studies were considered for this meta-analysis, and thus, further systematic reviews should also take qualitative studies into account.

Implication for education programming

Synthesising the findings of this review, there is a strong evidence of the effect of using teaching strategies based on students' needs and difficulties to improve learning outcomes. To be able to understand the problems in the classroom and to choose and implement the best-fit teaching strategy, our findings suggest that teachers should be equipped with sufficient comprehension of the subject matter and possess pedagogical knowledge as well as social skills. Supported by evidence from other factors, teaching practice should also include strategy to boosts students' psychological aspects, such as educational aspiration, motivation, and self-regulation.

With regards to support for teachers that leads to a better learning outcomes, evidence has shown that contractual-based teachers performed better than civil servant teachers. In addition to this, payment increase had no effect on teachers' performance[6]. Generally, therefore, the current system of providing higher incentives to teacher has not worked to increase learning. Instead, we find that support from the principal, in the form of supervision in teaching, and policies that increase parent engagement with teacher had a larger effect to the increase of the quality of learning.

[6] One explanation is that job security and wages policies are typically focused on medium- and long- term improvements to attract better teachers and compete with other sectors on the labour market. Therefore, the impact should be evaluated on new cohorts of teacher instead of the current in-service teacher. It is therefore not surprising these impact evaluations have not found any effect yet.

Implication for policy

Drawing a connection between the evidence across the different categories, we can conclude that teachers' ability to understand the problems and needs of students in the classroom, and to choose the best fitting strategies to address those needs are the keys to improving student learning. At the school level, our results show that supervision helped teachers to undertake appropriate teaching strategies in their classrooms. Finally, the current teacher incentive and employment policies do not seem to enhance the quality of teacher and learning in schools. Given that these policies require significant budget allocations, they need to be re-assessed or modified in order to achieve their intended purpose to increase student learning outcomes.

Limitation of the review

As discussed above, the reviewers found a very limited number of high quality studies and decided to include the medium quality studies to the review. Some medium quality studies did not employ a double blind experimental design and/or did not provide a complete report of the variables they had tested. In addition, some of the studies did not provide detail description of the population. Thus, it is important to bear in mind possible bias given by the medium quality studies.

The other consideration is related to the systematic search process employed in this study. Despite various combination of search terms used in various electronic databases, university repositories, donors and research institutes' websites or internal libraries, the review may still miss some donor funded project reports or other relevant resources.

Based on the above limitation, caution must be applied in interpreting the effect sizes of the factors, as the finding may not be universally applicable.

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