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# Understanding the impacts of floods on learning quality, school facilities, and educational recovery in Indonesia

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*This research is among the first pieces of work to use the comprehensive school safety (CSS) framework to assess the impacts of floods on quality learning and education infrastructure. The CSS framework is employed here to identify the level of disruption to education services following floods in Jakarta, Indonesia, in 2013. The paper poses three key questions, concerning: (i) disruption to children's access to quality education during the flood emergency in 2013 and the early recovery phase; (ii) the impact of the floods on a school's physical infrastructure; and (iii) the effectiveness and level of success of the 2013 flood responses by relevant stakeholders. Combining quantitative and qualitative strategies, the paper examines the experiences of 100 schools in Jakarta. The findings suggest that the CSS framework offers a more nuanced approach to assessing post-disaster education needs. Moreover, it is also relevant for examining the relationship between the COVID-19 pandemic and relative losses in the education sector.*

**Keywords:** comprehensive school safety, disaster risk reduction, flood impacts on schools, flood risk, Indonesia, infrastructure, Jakarta, learning recovery, school disruption, school recovery

## Introduction: disaster impacts on schools

Over the past two decades, a disproportionate number of boys and girls have been killed by natural hazards (Kousky, 2016). Disaster events triggered by natural hazards (such as floods and earthquakes) or pandemics (such as COVID-19) also often compromise children's access to education services, including the quality and quantity of learning. For example, floods and cyclones can cause loss of life, a decrease in learning opportunities (measured by hours to days of delays in implementing the schooling agenda), and damage to school facilities. Likewise, the COVID-19 pandemic has led to governments enforcing physical distancing, resulting in schoolchildren staying at home.

The impact of disasters on children ranges from complete disruption to a negative bearing on school attendance and academic performance (Mudavanhu, 2015; Gibbs et al., 2019). Unfortunately, existing statistical data on the effects of disasters on schools remain focused on the number of schools building being affected by such happenings (Amri et al., 2022)

It is quite apparent that such a sudden and unexpected transition from face-to-face classroom-based teaching to online teaching is enormously challenging for some 1.6 billion students worldwide (Miks and McIlwaine, 2020). It is imperative to understand, therefore, how disasters affect the safety and welfare of pupils, including quality of learning, and how potential declines in the quality of learning can be adequately assessed and effectively addressed.

Responding to the constant impacts on educational infrastructure and the lack of a post-disaster needs assessment and evaluation framework in the education sector, this study introduces a school safety framework to assess the effects of natural hazards in this regard. The research is experimental because it uses the comprehensive school safety (CSS) framework to comprehend the direct and indirect impacts of floods on children's education and schools in Jakarta, Indonesia. The CSS is often used as a framework for advocacy for disaster risk management planning in the education sector, including schools (GADRRRES, 2013). We argue that it can help researchers and policymakers gauge the consequences of disasters on school operations.

The CSS framework serves to identify the level of disruption to education services and their continuity following floods in the capital of Indonesia. This paper asks three key questions, concerning: (i) disruption to children's access to quality education during the flood emergency in 2013 and the early recovery phase; (ii) the impact of the floods on a school's physical infrastructure; and (iii) the effectiveness and level of success of the 2013 flood responses by relevant stakeholders. In the next section, we argue that the CSS framework could add merit to existing impact assessment frameworks in capturing school losses and damage. The third section sets out the methods of data collection; the fourth section presents the overall findings; and the fifth section concludes the overall research.

## **Frameworks for assessing the impacts of disasters on schools and education**

### **Past assessment frameworks: from the Damage and Loss Assessment to the Post-Disaster Needs Assessment**

School dynamics after a disaster remain unexplored in disaster studies. Comprehensive understanding of physical and non-physical losses following a large- or small-scale disaster is crucial to formulating a proper education recovery strategy. Unfortunately, there are not enough conceptual frameworks to assess the impacts of disasters on education. One of the most frequently used frameworks for such assessments in the past 40 years is the Damage and Loss Assessment (DaLA).

The DaLA framework quantifies disaster-related losses and damage by appraising primarily buildings and facilities, including furnishings, equipment, and education materials available in each type of school. This helps in estimating the unit construction costs per the physical properties of a school and the unit costs of equipment and education

materials and usual delivery times. These estimates are then translated into monetary losses (Jovel and Mudahar, 2010).

In the past 15 years, the DaLA framework has been superseded mainly by the Post-Disaster Needs Assessment (PDNA). The PDNA for the education sector suggests that assessments should consider the needs of physical assets (such as school buildings, offices, teaching and learning materials, and furniture), natural assets (such as land, water, and the garden), and financial assets (such as liquid items like cash and vouchers) (GNFDRR et al., 2015, p. 8). Unfortunately, the PDNA framework remains focused on the tangible impacts of disasters on education infrastructure, such as school buildings, and monetary losses. Current post-disaster recovery needs assessment instruments often overlook losses such as quality of learning in the education sector. A post-disaster non-physical impact assessment includes: closures or reduced operating hours of formal and non-formal education institutions at all levels; availability of alternative structured activities and temporary school shelters; human and material resources that may be needed for the establishment and maintenance of temporary learning spaces; and revenue losses that may affect the costs of providing education services in the future (GNFDRR et al., 2015, p. 8).

While these must be seen as indicators of good progress, such assessments are only conducted following large-scale disasters. Furthermore, human resources capable of gauging detailed losses post disaster are often unavailable locally (Jeggle and Boggero, 2018). The PDNA in the wake of the Nepal earthquake of 2015 reported total losses/damage in the education sector and detailed the cost of education recovery. Total damage and losses in the education sector were estimated at NPR 31.3 billion, including NPR 28 billion in physical assets and infrastructure losses. At least NPR 39.7 billion was needed for total recovery needs. The *Nepal Earthquake 2015: Post Disaster Needs Assessment* noted that: 'Educational services in the affected areas were severely disrupted by the earthquake. This is likely to have an impact on enrolment, attendance and internal efficiency, leading to an increase in the number of out-of-school children. It may also lead to an increase in the number of children with disabilities or significant injuries who may be unable to access education' (Government of Nepal, 2015, p. 11).

In many cases, such assessments miss out crucial details on losses, such as the number of days that schools were disrupted and how the disaster impacted students' educational outcomes. Notably, many hidden costs need to be expressed clearly and addressed appropriately by a PDNA.

Recent research from Metro Manila, Philippines, also suggests that the consequences of small-scale floods for school communities (students, teachers, and support staff) cannot be underestimated because such risks are extensive and can pose a considerable problem, especially for students from marginalised backgrounds. More importantly, the aggregate effects of such small-scale floods could equal or be higher than the risk of large-scale floods (Cadag et al., 2017). Cadag et al. (2017, p. 77) also identified quantifiable impacts, such as the suspension and disruption of classes, ranging from 8 to more than 12 days during small-scale floods per year in six targeted schools from 2009 to 2013, the absence of students and transportation difficulties, and schools and homes being poor learning environments.

## CSS as an impact assessment framework

A community of scholars pursuing disaster risk studies has existed for about 70 years (Tierney, 2013). The imperative to ensure safe environments for schoolchildren emerged 150 years ago and safe schools have long been at the centre of school safety discussions in academic and public policy circles (Viles, 1945, 1947; Alen, 2007). Viles (1947) argued that compulsory education policy must also mean shared responsibilities among stakeholders, including parents, to ensure adequate safety facilities. The push for safety also came from documents such as the *Guide for Planning Plants* issued by the National Council on Schoolhouse Construction in 1946 (Viles, 1947). Despite inconsistency in practice, public policy concerns about school safety can be traced back to legislation in New York in 1901 that required all schools to practise fire drills (Allen, 2007).

Nevertheless, it took almost a century for the broader global community to arrive at a point where the school safety agenda could become more comprehensive. Notably, since 2006, the topic of school safety has been receiving increased attention within the disaster risk reduction (DRR) community. UNISDR, the predecessor of the same-named United Nations Office for Disaster Risk Reduction (UNDRR), launched a two-year 'World Disaster Reduction Campaign', focusing on 'disaster risk reduction begins at school'. This was one of the first global advocacy endeavours initiated by UNISDR in 2006–07. In June 2009, during the second session of its Global Platform for Disaster Risk Reduction, nations were requested to undertake national assessments of existing education and health facilities by 2011.

The Children's Charter for Disaster Risk Reduction was launched at the third session of the Global Platform in May 2011 in Geneva, Switzerland. As a response to a High-Level Dialogue Communiqué at the fourth session of the Global Platform in 2013, the Worldwide Initiative for Safe Schools (WISS) coincided with the World Conference on Disaster Risk Reduction held in Sendai, Japan, in 2015. WISS 'is a government-led global partnership that aims at securing political commitment and fostering safe school implementation globally' (Caribbean Safe School Ministerial Forum, 2017, p. 17).

These developments have also galvanised momentum among other actors. Notably, the Global Alliance for Disaster Risk Reduction and Resilience in the Education Sector (GADRRRES), initiated in 2013 by United Nations (UN) agencies and international non-governmental organisations (NGOs), including the Inter-Agency Network for Education in Emergencies (INEE), recently developed the CSS framework.

This framework aims to: 'protect learners and education workers from death, injury, and harm in schools'; 'plan for educational continuity in the face of all expected hazards and threats'; 'safeguard education sector investments'; and 'strengthen risk reduction and resilience through education' (GADRRRES, 2014, p. 2). GADRRRES (2014, p. 2) proposes three pillars of school safety as a 'comprehensive approach to reducing risks from all hazards to the education sector': (i) Safe Learning Facilities; (ii) School Disaster Management; and (iii) Risk Reduction and Resilience Education (BNPB, 2012, p. 3).

COVID-19 has further contributed to expanding our understanding of educational outcomes of children due to a mass school closure. The National Centre for Student Equity

in Higher Education at Curtin University in Australia prepared a literature review that raised concerns about young people living in financially disadvantaged or low socioeconomic status communities (Drane, Vernon, and O'Shea, 2020). According to this review, a mass school closure may lead to long-term educational disengagement, digital exclusion, poor technology management, and increased psychosocial challenges among vulnerable children. A study on the impact of COVID-19 on school education in India revealed that 320 million learners from 1.5 million schools had been affected by the pandemic, and existing regional and digital disparities together with inequality have made e-learning impossible for many children, primarily those from disadvantaged groups in society (Modi and Postaria, 2020). In the developing country context, developmental deficits, a lack of vision, and governance inefficiencies have compromised the quality of public infrastructure. Despite doubling as an education provider and an emergency shelter, schools remain a neglected public good.

### School safety in the Indonesian context

The Government of Indonesia has endorsed school safety policy in the country through the National Agency for Disaster Management (BNPb)'s Regulation No 14/2012. This is an extension of Indonesia's ongoing disaster management policy reform that was initiated in 2007. Key goals of this process are to: (i) reduce disruption to educational activities while ensuring health protection and the safety of all children, including those with special needs, at all times; (ii) ensure safe learning facilities, including access to learning during emergencies and in the disaster recovery stage; (iii) develop schools as 'sites of community facility' that can be used to address poverty, illiteracy, and health problems; (iv) position schools also as a place for emergency coordination and disaster recovery; and (v) enable schools to serve and protect communities beyond schoolchildren and teachers.

The National Development Fiscal Plan (APBN) is one of the main national policy documents of the government. It commits to the allocation of resources for education recovery immediately after disasters. For instance, during 2013, IDR 5 trillion (approximately USD 500 million) of endowment funds were allocated to ensure quick educational recovery after disasters. Supported mechanisms included inter-regeneration responsibility, studentships/scholarships for poor students, and crisis contingency funds managed by the Ministry of National Education (MoNE) (Government of Indonesia, 2013, p. 31). However, there remains a lack of clarity about how the 'endowment fund' will be used by the MoNE after disasters. Despite the positive strides represented by the allocation, no funds were earmarked for education in emergencies (EiE) initiatives. Furthermore, the MoNE does not have its own disaster preparedness plan in place.

MoNE Permen No 72/2013 regarding 'Special Education Service (SES)' has been the umbrella instrument for providing EiE. The SES regulates education for students in remote areas, traditional communities, 'natural disaster'-affected areas, social disasters, and economically marginalised groups. It is the government's first regulation to define 'emergency education' as a temporary but formal arrangement in times of 'natural disasters' or 'social disasters' (*bencana sosial* in Bahasa Indonesia). Unfortunately, the SES neither

provides an operational framework for EiE nor guidance on the entitlements of children or teachers to retain essential school functions after disasters, including school repairs. Therefore, there is a need for a new and coordinated mechanism at the provincial level to facilitate the recovery of educational facilities, including a support system. Owing to these practical difficulties, it remains unclear how the MoNE will take the lead in responding to the education sector's needs in an emergency.

Thus, this study uses the CSS framework to assess the net impacts of disasters on schools in their entirety.

## Methods and data collection

### Methods

This research was designed in a similar manner to that of Cadag et al. (2017), which dealt with floods in Metro Manila, Philippines, from 2009–13. However, it deliberately deviates by focusing only on the impact of a single event, devastating floods in Jakarta in 2013, where relevant stakeholders including pupils and teachers remained in the same school after the event.

Table 1 summarises the evaluation framework, including the methods and the number of key informants from every region in the capital. The framework focuses on the aforementioned three key questions, concerning: (i) disruption to children's access to quality education during the flood emergency in 2013 and the early recovery phase; (ii) the impact of the floods on a school's physical infrastructure; and (iii) the effectiveness and level of success of the 2013 flood responses by relevant stakeholders.

This research utilises a mixed-methods approach, combining quantitative and qualitative data. It attempts to understand the impact of the 2013 flooding on access to quality education and schools' physical infrastructure and the effectiveness of the response of communities and the government of the Jakarta metropolitan area. The affected schools are defined as those that experienced closures, had inundated rooms, and suffered damage, as well as those that students and teachers could not access (see Table 1).

One hundred schools were randomly selected using simple random sampling while ensuring the inclusion of every region of the metropolitan city (see Table 2). The selection was made for a cross-section of schools based on location and instructional level. Only 80 school principals were available for interview; there were 20 non-respondents.

### Data collection constraints

The field research included visits to 100 schools at which 80 principals (see Table 2) and 21 students were interviewed. Of the 80 respondents representing the schools, 46.25 per cent (37 of 80) are principals and 32.5 per cent (26 of 80) are teachers; the remaining 21.25 per cent are non-teaching staff, of which 57.5 per cent (46 of 80) are women and 42.5 per cent are men. On average, the respondents had worked in their respective schools for about nine years.

**Table 1.** Methods, questions, and respondents

Areas of inquiry	Guiding questions	Method	Remarks
1. Disruption to children's access to quality education during the flood emergency in 2013 and the early recovery phase.	<ul style="list-style-type: none"> <li>• How do schools recover from floods?</li> <li>• What are the impacts on students' achievements/ learning outcomes?</li> <li>• What measures should be introduced to ensure educational continuity during/ after floods?</li> </ul>	Survey/semi-structured interviews from 10 October –8 November 2013.	Participants: 80 school principals.
2. The impact of the floods on a school's physical infrastructure.	<ul style="list-style-type: none"> <li>• Level and extent of damage to facilities?</li> <li>• Level and extent of damage to learning and teaching materials?</li> <li>• Cost of damage?</li> <li>• Length of time to replace?</li> <li>• Interim measures in place (temporary learning spaces and additional use of undamaged schools)?</li> </ul>	Survey/semi-structured interviews; focus-group discussion.	Participants: 80 school principals.
3. The effectiveness and level of success of the 2013 flood responses by relevant stakeholders.	<ul style="list-style-type: none"> <li>• What was the response of other stakeholders?</li> <li>• How does a school mobilise external support?</li> <li>• Is there any organisational mechanism in place?</li> <li>• How can schools contribute to their own recovery?</li> <li>• Speed and completeness of damage and needs assessments?</li> </ul>	Focus-group discussion on 14 November 2013. Survey/semi-structured interviews from 10 October –8 November 2013.	Participants: 10 selected school principals.

**Source:** authors.

**Table 2.** Flooded schools and selection of respondents

Region	Registered flooded schools	Schools affected (%)	Selected respondents	Responded	Percentage of responded
Central Jakarta	45	17	14	13	16
East Jakarta	56	45	24	24	30
North Jakarta	146	26	39	26	33
South Jakarta	26	6	11	11	14
West Jakarta	51	6	12	6	8
<b>Total</b>	<b>324</b>	<b>100</b>	<b>100</b>	<b>80</b>	<b>100</b>

**Source:** authors, using the flooded schools data of Dinas Pendidikan and the United Nations Children's Fund (UNICEF).



During the interviews, some principals said that their schools were neither flooded nor used as temporary shelters. These claims were completely contradicted by information shared by local communities living in the vicinity of these schools. One of the reasons could be that some heads joined the school after the floods in January 2013, but they chose not to delegate the interview to other staff members who might have provided more accurate insights.

In a few cases, principals requested a written questionnaire from the enumerators. When principals were not present, staff declined to respond. Student interviews were conducted during a short 15-minute recess, insufficient for reliable data collection. In some cases, survey forms were given to the teachers and/or the students to fill in and return later. The enumerators were volunteers from the Indonesia Humanitarian Forum, who were trained and briefed by the first and second authors before the field visits.

## Results: flood impacts on schools in Jakarta

### General overview

Jakarta experienced six major floods between 1997 and 2018 that temporarily paralysed economic and social activities in the city. The floods, in 1997, 2002, 2007, 2013, 2018, and 2019, were viewed as large-scale. According to media reports, these were one in five to six year events. The floods of 2007 are considered to be the most severe, whereas the flooding of 2013 is considered to be the most dramatic as the waters reached the heart of the capital.

The 2013 floods began on 16 January; by 17 January, approximately 25,000–30,000 people were temporarily displaced. In 2007, at least 70 per cent of Jakarta was flooded; While in January 2013, the total inundated area was believed to be even greater (Sagala et al., 2013). The Provincial Disaster Management Agency (BPBD) estimated that total economic losses due to the 2013 floods amounted to IDR 7.8 billion (about USD 750 million), 50 per cent higher than the economic loss estimate in 2007 of USD 500 million. The final death toll was 34 (BNPB, 2013.). According to the International Disasters Database, EM-DAT, almost 250,000 people (that is, 97,600 families) were affected by the floods in 2013. Significantly, the United Nations Children's Fund (UNICEF) reported that approximately one-third of those affected were children, amounting to 80,000 (UNICEF, 2013).

According to data from BPBD Jakarta, the 2013 floods inundated 431 low-lying sub-villages located along, across, and/or in-between 17 waterways, including 13 rivers that flow for 372 kilometres through the city. Jakarta has a total of 2,005 hectares of water body areas, excluding flood-inundated areas. Factors that contributed to the severity of the flooding included heavy rain, high tides, garbage-clogged waterways, canal collapses, environmental degradation, extensive urban development, and inadequate infrastructure (BPBD, 2013).

As of 2013, there were 7,046 schools in the Jakarta metropolitan area. Approximately 27 per cent (1,924) are kindergartens, 43 per cent (3,026) are elementary schools, 15 per cent (1,041) are junior high schools, 7 per cent (471) are senior high schools, and 8 per cent (584) are vocational schools. The distribution of schools by area is presented in Table 3.

**Table 3.** Distribution of schools by area in Jakarta, 2013

Region	Kindergarten	Elementary school	Junior high school	Senior high school	Vocational school	Total
Seribu Islands	10	14	7	1	1	<b>33</b>
South Jakarta	433	666	211	95	131	<b>1,536</b>
East Jakarta	601	847	261	121	192	<b>2,022</b>
Central Jakarta	207	384	120	61	68	<b>840</b>
West Jakarta	419	671	256	114	117	<b>1,577</b>
North Jakarta	254	444	186	79	75	<b>1,038</b>
<b>Total</b>	<b>1,924</b>	<b>3,026</b>	<b>1,041</b>	<b>471</b>	<b>584</b>	<b>7,046</b>

Source: BPS (2013).

In 2013, there were about 1.3 million students, including 850,000 in elementary schools, and almost 81,000 teachers in Jakarta.

Data on the impacts of floods on schools in Jakarta (in January 2013) were reported by three different sources. First, according to BPBD Jakarta, at least 586 educational facilities were damaged (BPBD, 2013)—a further breakdown of this data was not available. BPBD Jakarta data was estimated using geospatial data visualisation on inundation areas.

Second, the Jakarta Education Department (2013) reported on the floods as of 17 January 2013 (peak time), entitled *Sekolah Terkena Dampak (The Affected Schools)*. The report cited 324 schools as affected: 287 were flooded and 37 hosted displaced students and families; interestingly, one school was flooded and hosted people.

Third, the Education Cluster (2013) published an *Education Needs Assessment Report* in January 2013, reporting that about 8.3 per cent (70,000) of elementary schools were affected; 27 per cent of these students' homes were also affected by the flooding. The report identified 251 elementary and junior high schools as affected, of which 5 were destroyed, and 99 suffered some damage, 63 were easily repaired, and 69 experienced no damage.

## Access to quality education, disruptions, and recovery

### *Children's access to quality education during the flood emergency*

The findings, based on data analysis, suggest that the main reason for the disruption to school education, especially the closure of schools, was a problem with accessibility: teachers and students could not even get to school. Thirty-nine per cent of responders (28 of 72) cited inability to access school. Twenty-four per cent (17 of 72) reported that schools were used as emergency shelters, so routine educational activities were disrupted. Seventeen per cent (12 of 72) noted that students and teachers also spent educational activities time on cleaning up flooded floors in the school building. Eleven per cent of respondents (10 of 72) explained that the closure of schools/suspension of the schooling process was due to damage caused by floodwaters. Ten per cent of respondents (7 of 72) said that unavailability of teachers was the reason for school disruption/suspension.

Only 13 respondents stated that the school continued without interruption during the floods in January 2013 (these were included in the ‘missing’ 25 respondents; see Table 4). Most of the classes missed were not made up. Seventy-six per cent (61 of 80) of surveyed schools reported dismissing classes (that is, study sessions), whereas 25 per cent (16 schools) continued classes as usual. Three per cent of respondents (2 of 72) gave no direct answer (missing data).

When asked about the number of days that the school was completely closed, the answer was an average of three days with a standard deviation of 3.061 ( $N=80$ ), and a range of 0 to 20 days (see Figure 2). The average number of days that students were absent across responding schools was four days ( $N=80$ ; standard deviation of 3.368) (see Figure 2). Even when the schools reopened, some students still struggled to return.

Only one of the 80 respondents suggested that students or teachers were killed or injured in this flood. In contrast, three respondents (both students and teachers) noted that their household members were killed or injured due to the flood.

Figure 1 shows that on an average (mean value), 54 per cent of students ( $N=78$ ) and 19 per cent of teachers ( $N=77$ ) were affected by the flood. Six per cent of respondents estimated that none of their students was affected, and 39 per cent estimated that their teachers were not affected.

In Central Jakarta, at least two surveyed schools were inundated with 30–50 centimetres of water for more than three days. In West Jakarta, one school was under 70 centimetres of water for three days in a row. Some of the classrooms experienced a water height of between 30 and 100 centimetres from the floor. One school principal from East Jakarta reported that 10 rooms were flooded with water at a height of one metre.

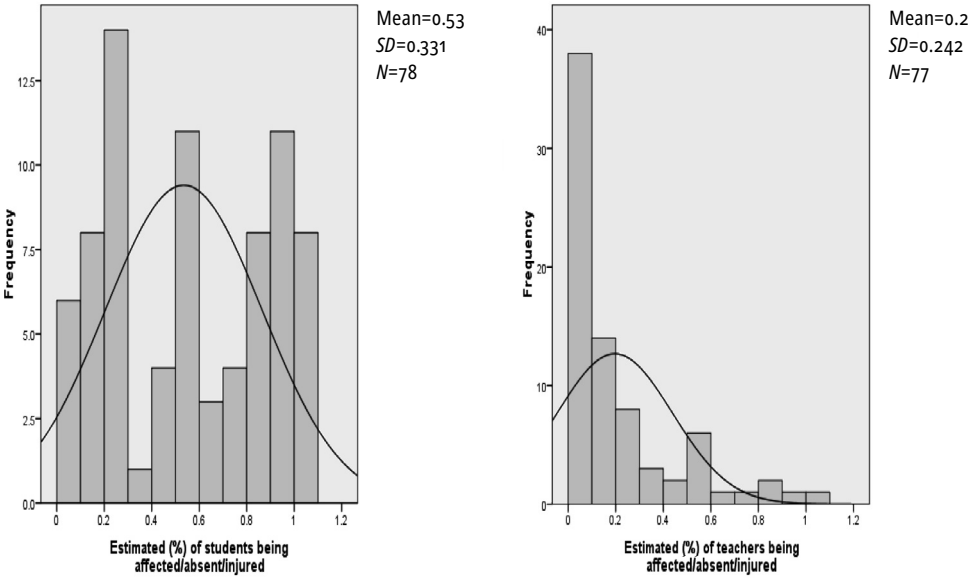
In East Jakarta, some affected schools did not stop running classes. One school, which was used as a temporary shelter for people from the local village for two days, also decided

**Table 4.** Reasons for school closure or disruption

Variables		Frequency	Percentage	Valid percentage	Cumulative percentage
Reasons for school closure or disruption	Owing to clean-up after flooding	6	7.5	10.9	10.9
	School not accessible by teachers and students	19	23.8	34.5	45.5
	School used as a shelter	11	13.8	20.0	65.5
	Teachers/students not available	1	1.2	1.8	67.3
	More than two reasons	6	7.5	10.9	78.2
	More than three reasons	2	2.5	3.6	81.8
	Not relevant	10	12.5	18.2	100.0
Total	55	68.8	100.0	–	
Missing data	System	25	31.2	–	–
<b>Total</b>		<b>80</b>	<b>100.0</b>	–	–

**Source:** authors.

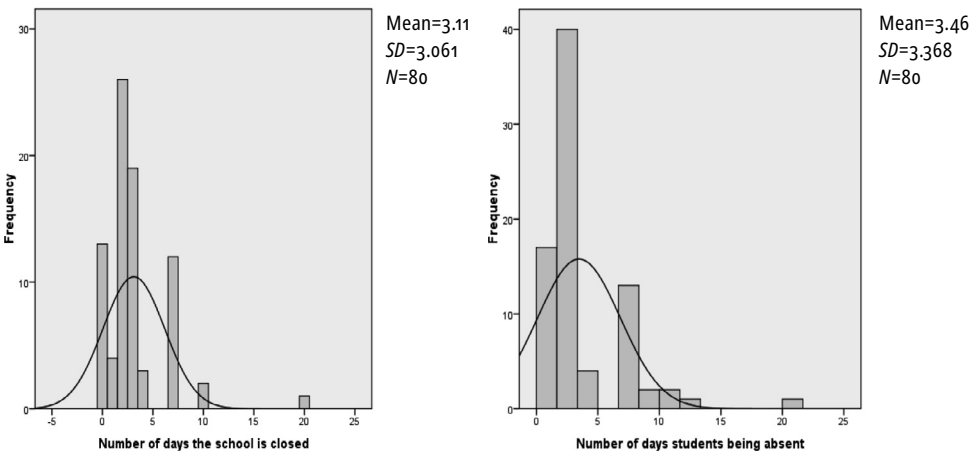
**Figure 1.** Estimated percentage of students and teachers absent and/or injured



Source: authors.

to maintain classes. Similarly, in South Jakarta, one school spared four rooms for a temporary school while continuing with its remaining classes as usual. The primary reason why schools stayed open and continued with educational activities in East Jakarta was their adaptiveness, owing to flooding occurring regularly in the area. A key condition imposed by some school principals is that people using school premises as a temporary shelter should not be a distraction to the learning/schooling process. Schools adapt by temporarily splitting into two sessions (morning and afternoon classes) and by making one-half of their classrooms available for sheltering flood-affected communities.

**Figure 2.** Disruption to and closure of schools (in days)



Source: authors.

Interestingly, one flood-affected school in South Jakarta could pursue educational activities without disruption because it shared the space with a nearby elementary school for two weeks. The principals opined that the locus of control was with the school authorities. Some schools could make their own arrangements, therefore, to avoid disrupting educational activities. A decentralised approach is truly reflected by responsibility being distributed among schools and results in a high degree of resilience. Nonetheless, this study recommends systematic guidance and support to schools. In addition, there is a need for thoughtful consideration of how a school's existing coping mechanism could become an established practice.

### *Recovery of access to quality education*

Schools in Jakarta adopted a two-pronged approach to rapid recovery. The priority was to enable schools to operationalise educational activities (classes) to prevent further student learning time being lost. The data indicate that the number of days that schools took to recover ranges from zero to 30. On average, schools or educational activities need six days to recover, meaning three days in addition to the average length of closure.

Twenty per cent of surveyed schools (16 of 80) reported that even one year after the floods (see Table 5), the repair of damaged assets or replacement work remained incomplete or had not been initiated at all. One question in the survey was: 'How many days or weeks did it take for the teaching and learning process to be 100% recovered?'. The findings suggest that 19 per cent of schools (15 of 80) required total repair and replacement of assets and facilities, needing between 14 and 90 days to recover. Thirty-three per cent of schools (26 of 80) needed less than two weeks to recover fully (see Table 5), whereas 14 per cent of schools (11 of 80) needed between two and four weeks to replace damaged facilities or assets. Another 14 per cent of schools (11 of 80) took between one and three months to recover fully. Only two schools (2.5 per cent) took between three and six months to recover.

### *Impact of the floods on students' learning outcomes*

The floods affected pupils, teachers, parents, and support staff, including their schools and homes. To revive quality education, schools adopted various strategies. These included providing additional time to students to complete the minimum requirements and accelerated lessons by teachers to complete the syllabus. Seventy-eight per cent of school principals (62 of 80) noted that the floods had little or no impact on students, measured by two criteria: successfully passing the final national examinations; and grades achieved.

Some school principals (12 of 80) suggested that learning time lost due to the floods should be compensated by additional time to prepare for the national assessment. Three (of 80) respondents felt that the floods affected students' ranking in the national assessment, and that expected grades were not achieved. Three respondents mentioned that the school's teaching materials were washed away, partially jeopardising learning opportunities. One principal stated that despite the 100 per cent pass rate in the national assessment, 'some students lost their learning spirit' (see Table 5).

**Table 5.** Time required for the recovery of classes and perception of the impact of the floods on students' learning outcomes

Variables		Frequency	Percentage	Valid percentage	Cumulative percentage
Time required for the recovery of classes	Less than 2 weeks	26	32.5	35.6	35.6
	2–4 weeks	11	13.8	15.1	50.7
	1–3 months	7	8.8	9.6	60.3
	3–6 months	2	2.5	2.7	63.0
	Not yet replaced	11	13.8	15.1	78.1
	No damage	16	20.0	21.9	100.0
	Total	73	91.2	100.0	–
	Missing data	7	8.8	–	–
<b>Total</b>		<b>80</b>	<b>100.0</b>	–	–
Perception of the impact of the floods on students' learning outcomes	No impact	62	77.5	77.5	77.5
	Yes: delays to learning; and additional time needed to be prepared for examinations	12	15.0	15.0	92.5
	Yes: books lost to the flood; and lost opportunity to learn	3	3.8	3.8	96.2
	Yes: changes to ranking in the national assessment; and targeted marks not achieved	1	1.2	1.2	97.5
	Not sure	2	2.5	2.5	100.0
<b>Total</b>		<b>80</b>	<b>100.0</b>	<b>100.0</b>	–

**Source:** authors.

Principals also reported that preparation for the final national examinations was affected by the floods, notably because of the cancellation of some trial lessons. Impacts on the photocopy industry also added to the delays. One respondent remarked that schools should be allowed to adapt flexibly to the situation by making up school days to compensate for the time lost due to the flood.

A limited number of respondents reported no bearing on learning outcomes. The timespan from January to April/May was seen as long enough for students to make up time lost and prepare for the national assessment. To support this claim, this group of respondents cited that 100 per cent of their students passed the final examinations, and that the overall average of marks was higher than in previous years. Interestingly, they added that 'students get used to the floods'.

### *Measures to ensure educational continuity*

Some schools attempted to ensure continuity of learning activities and processes. Table 6 shows that 43 per cent of schools (35 of 81) added extra hours to routine school timings to cope with time lost to the floods. Twenty-three per cent of respondents (29 of 81) coped

**Table 6.** How lost school time was handled

Variable	Options	Frequency
How lost school time was handled	Additional assignments and homework	29
	Speed up classes	11
	Extra time allocation for schooling	35
	Creative policy approach, such as longer time for book loans	1
	No policy/no clear policy	20
<b>Total</b>		<b>81*</b>

**Note:** \*  $N=81$ . Multiple answers possible.

**Source:** authors.

with the lost time by introducing more assignments or additional homework. Several respondents acknowledged that these strategies are a 'standard coping mechanism' whenever schools experience disruption for any reason. Other initiatives include conducting make-up lessons after regular school hours or classes at the weekend. In their final year, grade six, elementary students needed to attend school on Sundays for even more make-up lessons and extra preparation for examinations.

Some respondents (11 per cent) accelerated teaching by 'compacting' the delivery of instruction time. One respondent suggested a creative policy of granting students longer time for book loans. Twenty-six per cent of respondents said that they had no means of compensating for the time lost to the floods. Thirteen per cent reported that their schools were somewhat slightly affected by the floods, and hence they did not feel that it was necessary to organise make-up lessons (see Table 6).

Three additional coping strategies mentioned were: introducing group-based activities instead of individual classroom projects; moving classes to nearby non-affected schools; and continuing education activities in the non-affected classrooms of the flood-impacted schools. However, it is important to note that some flood-affected schools decided not to pursue any of these options and did not make any efforts to ensure continuity of learning.

## Impact on and recovery of schools' buildings and facilities

### *Impact of the floods on school buildings*

The impact of the floods on school buildings was categorised in four damage types: no damage; minor damage; moderate damage; and complete damage. The sample schools reported that 46 per cent (37 of 80) experienced no damage, 36 per cent minor damage, 9 per cent moderate damage, and 6 per cent complete damage (see Table 7).

The time required for recovery and repairs entirely depends on access to funds, not the severity of the damage to school buildings. The damaged schools needed between 26 days and six months to replace or repair flood-affected buildings. With regard to our 80 sample schools, there is no significant association (two-tailed Pearson correlation) between levels of impact on buildings and either time required for total recovery/replacement or estimated monetary losses.

**Table 7.** Impact on and time required to repair school buildings

Variable	Range	Frequency	Percentage	Valid percentage	Cumulative percentage
Impact on school buildings	No damage	37	46.2	46.2	46.2
	Minor damage	29	36.2	36.2	82.5
	Moderate damage	7	8.8	8.8	91.2
	Complete damage	5	6.2	6.2	97.5
	Do not know	2	2.5	2.5	100.0
<b>Total</b>		<b>80</b>	<b>100.0</b>	<b>100.0</b>	–
Time required to repair school buildings	Less than 2 weeks	26	32.5	40.6	40.6
	2–4 weeks	11	13.8	17.2	57.8
	1–3 months	7	8.8	10.9	68.8
	3–6 months	2	2.5	3.1	71.9
	Not yet replaced	11	13.8	17.2	89.1
	No damage	7	8.8	10.9	100.0
	Missing data	16	20.0	–	–
<b>Total</b>		<b>80</b>	<b>100</b>	<b>100.0</b>	–

**Source:** authors.

### *Impact of the floods on school facilities*

Approximately 60 per cent of surveyed schools reported damage to their infrastructure, equipment, or facilities (48 of 80). Damage to books and/or the library was reported by 52 per cent of schools (25 of 48) (see Table 8). Thirty-one of 48 respondents reported

**Table 8.** Pattern of damages to school facilities

Damaged item	Responses	Average level of damage (one to five scale)
Garden	9	2.00
Furniture	31	2.71
Computers	16	2.50
Other electronic assets	12	2.08
Students' projects	16	2.56
Teachers' materials	14	2.71
Important documents	6	2.00
School building (walls)	4	1.75
Books and library	25	2.84
<b>Total/average</b>	<b>133</b>	<b>2.35</b>

**Note:**  $N=48$ . Multiple answers possible.

**Source:** authors.



damage to furniture, which is also the most frequently reported damaged item. On a scale of one to five, the average level of damage was 2.71. Damage to computers and/or students' project materials was reported by 33 per cent of respondents (16 of 48).

Only 12 schools could provide an estimated cost of damage in Indonesian rupiahs. The average estimation, based on observation of 12 schools, was the equivalent of USD 2,000 per school. However, this estimate is not considered to be reliable owing to the lack of verifiable documentation on the value of assets damaged by the floods. Schools have no obligation to produce this data. Future research should explore this aspect more specifically given the absence of clearly laid out procedures to seek funds for school recovery.

## Effectiveness of the school response strategy

### *Support mobilised by external and internal actors*

Following the floods of 2013, a number of actors provided support to facilitate the recovery of affected schools. Twenty-six per cent of schools (21 of 80) did not receive any external support. Most of the schools requiring financial assistance for recovery, 36 per cent (29 of 80), relied on their own resources and used the school's operational funds. Thirteen schools in need (16 per cent) received support from the Education Department

**Table 9.** Recovery support and mobilisation

Variables		Frequency	Percentage	Valid percentage	Cumulative percentage
Recovery support and mobilisation	No help received	21	26.2	27.6	27.6
	From foundations	7	8.8	9.2	36.8
	From the Education Department and or local government	13	16.2	17.1	53.9
	From school operational funds	29	36.2	38.2	92.1
	From school and anyone external	5	6.2	6.6	98.7
	School-to-school support mechanism	1	1.2	1.3	100.0
	Total	76	95.0	100.0	–
	Missing data	4	5.0	–	–
<b>Total</b>	<b>80</b>	<b>100.0</b>	–	–	
Disaster management policy at school	Yes	39	48.8	52.0	52.0
	No	31	38.8	41.3	93.3
	Either yes or no, not written but established	5	6.2	6.7	100.0
	Total	75	93.8	100.0	–
	Missing data	5	6.2	–	–
<b>Total</b>	<b>80</b>	<b>100.0</b>	–	–	

**Source:** authors.

and local government (see Table 9). Only seven schools reported getting support from private foundations. Marginal but worth mentioning school-to-school support (non-affected schools helping affected schools) was a significant development that warrants further exploration in the future.

### *Disaster management and preparedness measures in schools*

Table 9 shows that 52 per cent (39 of 75) of schools reported having a school-specific disaster management plan. While 41 per cent of schools did not have such a plan, seven per cent stated that they have no written policy, but due to the regular occurrence of floods, they have specific procedures in place.

When asked ‘Does the school have a standard operating procedure (SOP) for dealing with flood emergencies? If ‘yes’, when was the SOP developed?’, only 31 per cent of 74 school representatives reported having a SOP; the remaining 69 per cent said that a SOP does not exist or is still being developed. Of those schools with a SOP, about two-thirds (65 per cent) admitted that it was adopted a long time ago, whereas the remaining 35 per cent said that it was developed recently.

Around 81 per cent of those schools with disaster management plans and a SOP have admitted that these are effective in times of crisis. Notably, all students remained safe despite severe floods, and there was no damage to most assets and facilities, including important documents, records, and books. Just five per cent of schools opined that their flood risk management measures were not very effective. Fifteen per cent added that the existence of a SOP led to improved awareness among staff and students alike.

Only a handful of SOPs clearly state that ‘if floodwater enters or inundates the school building, especially classrooms, students must return home’. Three respondents were even more specific, mentioning that ‘if floodwater rises to the seat of the chairs (or about 30–50 centimetres), students should return home immediately, or the classes dismissed, or students evacuated’, although it was not clear where they were to go and how to evacuate. Most SOPs also state that a ‘school’s assets must be saved/rescued by moving them to a higher level’. It is noteworthy that schools continued with regular educational sessions despite warnings and cancelled them only after flooding began.

It seems extraordinary that children are released and sent home only after the school encounters floodwater. However, this response was evident from schools in North Jakarta and East Jakarta, because of their frequent experience of floods of more or less predictable height. Moreover, these frequent events were not flash floods, but ones with a longer lead time for early warning. Sadly, at times, this experience of living with flood risk also spawns complacency and hence underestimates of the potentially hazardous impacts.

During the flood emergency of 2013, 95 per cent of school principals (74 of 80) reported losses and damage to school buildings and educational facilities to their supervisory agency. Only three per cent of schools did not send such reports, and one respondent was unable to recollect whether a report was sent or not. Seventy-seven per cent of schools used some template for post-disaster reporting, whereas 20 per cent did not have any such template. Approximately three per cent of respondents do not remember using a template.

## Validation of the survey findings

### *Findings from the focus-group discussion*

This subsection is based on the findings of a focus-group discussion (FGD) conducted with 30 participants, mostly teachers and school principals, on 14 November 2013 in Jakarta. Participants were grouped into five groups of six persons. The FGD started by comparing schools' experiences during the two most recent large-scale floods, in 2007 and 2013. Most participants reported that the impact of the floods in 2007 was worse because people did not have prior experience of dealing with an event of this magnitude, despite large floods in 2002. Notably, both of these events were on different scales.

In addition, after 2007, children and teachers began to receive training from various stakeholders in how to deal with floods. Participants were aware that capacity-building efforts at the school level had been made through local government, UNICEF, Save the Children, and other partners (that is, Education Cluster members). Respected organisations engaged in flood preparation and response training in West Jakarta, North Jakarta, East Jakarta, Central Jakarta, and Depok. One group noted that their teaching capacity has improved through the training. Although limited in number, there were examples of school-level appointments of incident commanders and school-based response teams. In the absence of a written policy on such appointments, it was concluded that this is an informal arrangement rather than a systematic one at this stage. Teachers also noted no information on safe school and disaster-resilient school construction design.

The FGD further validated findings from the survey focusing on the impacts of the 2013 floods on the education sector, including:

- school facilities have been damaged;
- schools used as emergency shelters experienced additional delays and interruptions to teaching and learning processes;
- students were not able to meet minimum targets for lesson completion; and
- attention of staff to teaching and learning was severely affected both quantitatively and qualitatively.

Almost every survey participant agreed that as far as the quality of preparedness and response in the education sector is concerned, significant progress was made between 2007 and 2013. A teacher from a senior high school reported: 'nowadays, every time the rainy season comes, I am invited by the mayor and related agencies to get training for preparedness against floods. Coordination is now better than before. The assistance [from the government] is also getting better'. The normative expectation that schools *should* be well-prepared for floods is also recognised as positive.

The perception of FGD participants was that there was no specific training for *flood* risk reduction on the curriculum. However, they recognise that notions of prevention, safety, and disaster response, in general, were integrated into several subjects, especially science, social studies, gymnastics, and extra-curricular activities such as Scouts and Red Cross youth movements in schools.

When it comes to availability of information on flood conditions, participants understand that information about water levels from BPBD Jakarta can now be accessed via websites, electronic devices, and social media applications such as Twitter. The information is updated every hour. Informed decision-making at the school level is constrained by the limited access of teachers and students to information on the water level and weather. One notable shortcoming is that information on water levels is not linked to specific, actionable early warning messages.

Teachers recommended improving flood early warning information (on when floods are likely to affect schools, including current and expected water levels). Local impacts need to be transmitted to schools as early as possible to anticipate whether any part of the building(s) can be used for teaching or as an emergency shelter.

Triggers for the cancellation of teaching before the school day begins (most protective) versus releasing children to go home on their own versus implementing safe family reunification procedures remained unclear. The child protection hazards associated with releasing children from school during a flood and various alternatives were not fully seen as matters of policy or practice.

Jakarta's bureaucratic system is viewed as not sufficiently responsive to EiE needs. Post-disaster support to schools, especially communication, needs to be systematic. Furthermore, participants felt that post-disaster aid focused too much on support for early elementary grades (one to three), toys and play, and not on recovering the learning time lost.

Regarding the use of schools as shelters, there is tension between the need to meet the rights of displaced people on the one hand and, on the other, schools' concerns about recovering classes and the learning process as early as possible. The lack of systematic guidelines for the limited use of schools as shelters, and the absence of educational continuity planning at all levels of the education sector, are recognised by respondents as a deficit.

In a grading-oriented culture, a few respondents reported no impact on learning outcomes. To recap, they felt that the timespan from January to April/May was long enough for students to compensate for events and prepare for the national assessment. They maintained that 'students get used to the floods'. As proof, they cited that 100 per cent of their students passed the final examinations, and the overall average of the marks was higher than in previous years.

Overall, Jakarta city has a better system of dealing with risk management today than in the past. The BPBD's Flood Contingency Plan includes the Education Department, whose task is to address treatment and/or intervention in flood-prone schools. Respondents were divided as to the quality of the response systems in the education sector during the floods of 2013. Seven out of 10 informed stakeholders were not satisfied with the response; only three were satisfied.

### *Students' perceptions of the flood impacts*

Twenty-one students were interviewed, 12 females (57 per cent) and 9 males (43 per cent). The age range of the respondents was between 10 and 18, with a mean value of 12.57

( $SD=2.2$ ). They were selected by the interviewed schools' principals based on their availability. While the students do not represent all schoolchildren in Jakarta, they do shed light on the experiences of affected children. All interviewed pupils reported that their family was affected by the floods, and 95 per cent said that their school was affected by the floods. Almost one-half of those interviewed had experienced their school being used as a temporary shelter, and 86 per cent stated that their school was closed due to damage or was being used as an emergency shelter.

### **What students remember most**

Students reported that the floods reached houses from the yard up to the roof. One female student recalled: 'Raining for days makes the dams collapse, as I saw on our way home. Houses were submerged to chest level'.

Some people were displaced to nearby mosques and moved to stay with extended family and friends. They remember the most damaged houses; some people were stranded on the second floor of their houses for days. Some suffered food shortages and health problems. Some could not find ways to go out of their house because the roads were inundated, ranging from a few hours to a week. Shoes were lost and furniture was swept away by the water. There were a lot of displaced people, and people got sick, such as from fever and typhoid. Fire due to a short circuit also occurred.

Some of the students reported being isolated at home with no access to school for days. In one of the schools, students were asked to move books to higher places, raise cabinets, and clean the library.

### **Students report on school impacts**

Overall, the students experienced school closures of 1 to 12 days, with a mean of 4.62 ( $SD=3$ ). Classes restarted between 1 and 14 days after the floods ( $M=4.48$ ,  $SD=3.3$ ).

Most of the students who did not go back immediately to school said that their uniform was either lost or became dirty/wet. As a result, 61 per cent ( $N=21$ ) did not go back to school immediately. Only 19 per cent did so. The remaining 20 per cent were unsure about what they did straight after the floods.

Seven of the 21 students (33 per cent) said that they lost personal belonging such as books, notebooks, and shoes. Eight (38 per cent) said that they did not experience any losses. The remaining six (29 per cent) were not sure.

### **Student reports on early warning of floods**

Seventy-six per cent of the students (16 of 21) said that they received an early warning message. The rest (24 per cent) did not receive any such warning. This highlights the importance of social networks for warning services and the lack of clarity about sources of early warning. The range of sources of information included neighbours, teachers and peers, and notification from the RT (*Rukun Tetangga*, or neighbourhood chief) and mosques and television (only one). The less visible role of television in delivering warning services to the students may indicate a weakness of technology: the electricity supply was also affected during the floods.

## Students' understanding of school-based disaster planning

Two-thirds of students said that they knew about the existing school plan concerning what to do in times of flooding. One student explained that the plan is to drop rubbish in the waste bin, to move books and furniture to a higher level, and to be ready when the water reaches your feet. However, common elements of school-based disaster risk management planning, such as a risk assessment, risk reduction measures, an emergency SOP, and educational continuity planning, were not mentioned.

## Final remarks

The findings pertaining to the Jakarta floods of 2013 confirm recent findings from Metro Manila, Philippines: the net effects of floods on school communities (students, teachers, and other members of staff) cannot be underestimated because such risks go beyond present understanding of disaster impacts on education (Cadag et al., 2017). Further documentation of school losses and disruptions is needed in different contexts, such as small towns and rural settings.

Indonesian national disaster statistics often provide very rough data on affected school buildings. For example, data suggest that at least 35,300 schools were affected by multi-hazard disasters in 2005–19 (Amri et al., 2022). There is a need to include schools in disaster statistics, and new variables need to be considered in advocating for the use of a CSS framework to inform data collection. A CSS framework can help local and national governments thoroughly assess the effects of disasters on schools.

Our research indicates that schools and local governments did not have the guidance needed to anticipate and introduce risk reduction measures to cope with floods or other natural hazards. Guidance for schools on risk reduction and educational continuity planning, response, and recovery are needed from the national and district level.

Our assessment also reveals that to ensure the regaining of access to quality education, schools adopted various strategies, including providing extra time to students to complete minimum requirements and accelerated lessons by teachers to finish the existing syllabus. Interestingly, the majority of the school principals perceived that the flood had little or no impact on student learning outcomes when measured by the rate of success in the final national examinations and grades achieved. Although some recommended that learning time lost to the floods should be compensated by adding extra time to prepare for the national assessment.

The consequences for education have never been adequately quantified and described. Information on declines in the amount and the quality of learning cannot simply be based on hourly losses, as pointed out by Mudavanhu (2015). The ramifications of COVID-19 for school education is a somewhat more visible and global-scale example that validates our argument.

The magnitude of disaster events matters. We found that one out of every two students in Jakarta was affected by the floods in 2013, which is a massive proportion. The impacts of floods on education go beyond the school environment (for instance, children

and teachers), affecting also parents, settlements, and infrastructure. A study of hurricane recovery in the United States found that ‘teachers’ physical, social-emotional, and classroom needs’ also require attention to expedite recovery (Cannon, Davis, and Fuller, 2020, p. 7). ‘Being affected by floods’ means disruption to and delays in schooling, which manifest in many forms: for example, students and/or teachers could not go to school due to blocked roads and/or flooded houses or classrooms.

Adequate early warning plans for family reunification, and the provision and maintenance of boats and flotation devices, deserve systematic consideration. School facilities can be made safer by paying attention to aspects such as elevating school floors—existing floors are impacted too quickly during floods. Some suggested moving schools to higher ground and away from frequently inundated areas. Others suggested locating schools at least 200 metres from the nearest known area of regular flooding.

Safe evacuation and family reunification are crucially important. In general, local governments are considered to be responsible for ensuring that schoolchildren return home safely. This suggests that school-based contingency planning should include detailed scenarios involving schools and respective local government agencies and village structures, to ensure that each pupil returns home from school in a timely manner and is not exposed to dangerous and often toxic floodwaters (contaminated by hazardous materials and waste). Apropos of COVID-19, contingency planning may also include lockdown-related disruptions and readiness to move to an e-learning mode quickly. However, cyclones and earthquakes often affect digital access and internet infrastructure.

School-to-school pre-disaster arrangements for classroom sharing should also be explored as a resource for preparedness planning in flood-prone urban areas, not only in Jakarta and Manila, but also in Bangkok (Thailand), Colombo (Sri Lanka), Dhaka (Bangladesh), Mumbai (India), and other places. Such an arrangement was observed in New Zealand following the Christchurch earthquakes in 2011 (Ham et al., 2012). Schools should be ready to adopt national-level guidance on disaster management and risk reduction and continuity planning, including epidemic/pandemic planning. However, schools should also enjoy some degree of autonomy in adapting these guidelines to their own specific conditions, and they should be able to explore mutual aid relationships with nearby schools and collaborate with local authorities, communities, charities, donors, and parents.

The CSS framework has value in assessing the impacts of a disaster on schools in three dimensions: education continuity; the consequences for physical facilities; and safeguarding of resilience through education. We suggest that CSS be integrated into PDNA processes in the education sector. A new assessment instrument, the United Nations Educational, Scientific and Cultural Organization’s 10 key recommendations to ensure that uninterrupted learning during the COVID-19 crisis (UNESCO, 2020), will significantly change the way in which educational recovery is assessed, planned, and managed from now on.

We recommend that governments and child- and education-focused organisations initiate comprehensive loss assessments of schools, including soft and hard elements. This is a crucial step towards identifying lessons for recovery and risk management planning

in the education sector in the future. School safety and disaster risk reduction advocates should also understand the institutional landscape and governance context (Lassa et al., 2019) to generate political commitment for ambitious school safety programming.

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## Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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