Challenges and Benefits of Community-based Safer School Construction

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ABSTRACT

Over the last two decades, millions of classrooms have been built through such efforts as the global Education for All campaign and the Millennium Development Goals. Community-based school construction is prevalent in areas where the onus of education has traditionally been on the community or where governments has devolved decision-making to subnational or local bodies. Interviews with 58 practitioners with expertise in community-based construction in Africa, Latin America, and Asia illuminate both the challenges and benefits of community-based approaches. These practitioners sought to achieve the twin goal of ensuring children have access to educational facilities and ensuring such facilities are able to withstand natural hazards without costly damage that can kill, injure children and school personnel, or disrupt education. Practitioners found that community-based approaches to safer school construction can support local livelihoods and build capacity; the approach can also increase the skills of local stakeholders for maintaining the school after project completion. It also helps develop local capacity for disaster risk management. However, practitioners noted that introduction of new materials and construction techniques, which may be necessary to achieve hazard-resistant construction, were sometimes resisted or ineffectively implemented. Other times, decisions at the design stage did not adequately reflect field realities, increasing risk to future occupants. Overall, reduction in labor and material costs often came with slower construction and higher costs devoted to local training and oversight. The insights help identify key principles for community-based construction that can help ensure safer schools and increased community capacity for disaster risk reduction.

1. Introduction

At the start of the millennium, the global vision of expanding access to education to all children, enshrined in the second Millennium Development Goal (MDG) of achieving universal primary education, led to an extraordinary investment in the education sector. According to the 2015 United Nations Millennium Development Goals report, from 2000 to 2015 enrollment in primary school in developing regions soared from 83% to 91%. Even as population expanded, 43 million fewer primary school-aged children were out of school due to poverty, conflict, and discrimination. These gains were especially pronounced in sub-Saharan Africa, which also grappled with rapid population growth, and Oceania. In these two regions, enrollment increased from 60 to 80% and 69 to 95% respectively during the 15 year MDG planning period. The push for universal education was especially beneficial for girls as many regions reached gender parity in primary school education for the first time [1].

The expansion of educational access, spurred by the millennial and sustainable development goals, came with a construction boom funded by bilateral and multilateral aid. With the abolition of school fees and rising numbers of school age children, more children simply needed schools. Further, to reach gender parity for girls, schools needed to be close to home [2].

To bring schools to these children, official development aid rose from USD $72 billion in 2000 to $133 billion in 2015 (2017 USD), with around 8% of this aid going to education each year [3]. Individual governments gave over USD $9 billion annually in 2011 and 2013 in
education sector aid to low and middle income countries. Multilateral organizations, such as the development banks and United Nations programs, donated another USD $1 billion annually [4]; during this period around 4% of the foreign assistance from the World, Inter-American and Asian Development Banks went to education [5]. Other international aid organizations also contributed, though at a smaller scale. Internal data from Save the Children indicates that global education sector construction spending is on the order of USD $10 million annually, with costs ranging from around USD $5,000 for temporary classrooms to USD $30,000–50,000 for permanent classrooms, including costs of site preparation, sanitation facilities, and access. Supportive of this investment were findings that investment in primary education provided the highest economic returns of all education sector investment [5].

Despite immense gains, critical disparities and ineffectiveness persist. Children of the poorest households, those in remote areas and conflict zones, and children with disabilities are still out of school in many places or fail to finish mandatory schooling in their country [1,6,7]. For others, the quality of educational facilities and availability of trained teachers impede learning [8–10]. Education sector aid may supplant domestic spending or increase enrollments without necessarily improving learning. Globally, there seems to be little correlation between aid and national primary school completion rates [5]. Further, where employment pathways are limited, students may see little point to having access to education. Yet, even where expanded access has been a meaningful improvement, natural hazards may threaten these developmental gains.

1.1. Education sector exposure to natural hazards

Schools are often located in areas of high exposure to natural hazards. Rapid growth in Asia-Pacific cities is pushing people into ‘extreme high risk’ areas and peri-urban construction is often shoddy and inadequate [11]. Over a billion students worldwide attend primary and secondary schools in high seismic risk zones and other hazards like landslides, cyclones, and floods threaten millions of other schools [12]. In the next decade, over 200 million children per year will experience disasters [13]. While comprehensive, multi-hazard data are unavailable, these statistics suggest a staggering level of education sector exposure to natural hazards.

When natural hazards do strike schools, the quality of school construction and hazard exposure of school sites has immense implications. Tsunamis, such as those that struck Indonesia in 2006, Chile in 2010 and Japan in 2011, destroyed thousands of schools located in the tsunami inundation zones [14]. Earthquakes, such as those that struck Pakistan in 2005, China in 2008, Haiti in 2010, and Nepal in 2015, caused upwards of 80% of the classrooms in the most affected regions to collapse [15,16]. In China alone, officials estimate that over 5,000 children died or were missing, most in collapsed classrooms [17]. In Pakistan, primary school enrolment dropped by nearly five percent [11]. Cyclones in South East Asia regularly peel off schools’ roofs, often leading to the partial or complete collapse of the educational facilities [18]. Flooding too has grave consequences, as events such as Hurricane Katrina in the United States and seasonal flooding in Southeast Asia and southern African countries can attest [19]. While flooding less frequently cause school collapse, it too damage facilities. For example, over a third of the flood-damaged schools in Malawi in 2015 needed to be rebuilt [20]. Further, floods often force school closure for weeks and months, undermining broader community recovery and disrupting children’s educational trajectories [19,21].

Yet, natural hazards appear to be poorly addressed in a majority of school construction projects. In some context, governments do not have accurate measurements or understanding of hazard frequency, magnitude or spatial extent. Building codes do not reflect the latest hazard risk profile and therefore cannot accurately integrate hazards into design loads. Moreover, poor planning, design, and construction – stemming from land scarcity, limited resources, corruption, and unfamiliar building technologies – increase the fragility of school facilities and contribute to devastating loss of life [22]. Important global efforts, such as the child-friendly schools framework, focus on providing strategies for ensuring socially safe and inviting environments, but may not address the devastating potential for loss of life, injury and lost educational opportunities posed by natural hazard events [23]. Often donors, governments, and non-governmental organizations (NGOs) building new schools do not have accountability strategies to ensure planning, design, and construction follows rigorous standards to ensure school building safety. Even when one hazard is considered, those overseeing school construction may fail to take a multi-hazard approach [19]. Thus, international and national education expansion campaigns that require students to attend schools, yet do not guarantee the hazard resistance of such schools, place students at enormous risk and create the specter of the state and development partners becoming directly responsible for the death of children in disasters.

1.2. Community based construction

A portion of schools built during the push for greater educational access, as well as some built during disaster recovery, can be considered community-built schools. Community-based school construction occurs when community stakeholders, such as parent, youth, neighbors, and community leaders, are involved in the school construction process, often to a considerable degree. Stakeholders may directly select sites for school construction, raise funds to build schools, provide labor during construction, or comprise committees overseeing the planning and construction of the school facility. Throughout school construction, they may be involved in decisions related to hazard exposure and safety [12,22,24,25]. In its most involved form, the community acts as a project manager, overseeing the construction process – the “administrative, technical, financial and business-related aspects of the development of the building, including design, construction codes, tender, selections of contractors/sub-contractors, business negotiations, follow-up, and completion of work” ([12]; p. 16). They receive technical and/or financial support through non-governmental organizations (NGOs), donors and development partners, and national ministries of education and/or local governments [12].

The impetus for taking a community-based approach to school construction may evolve out of a range of considerations. Traditional community-based school construction is most common in low- and moderate-income countries where governments do not have enough financial resources, technical expertise, or capacity to build schools in every community [26]. Community-based school construction is also prevalent in areas where the state has traditionally put the onus of education and school management on the community, rather than the state. Communities may also be important actors in school maintenance and repair. In some countries, a community-based approach has been used for school retrofitting or rebuilding projects [27]. However, the technical challenges of retrofitting require careful consideration. These techniques may be beyond practices with which the community is familiar [28,29] and socio-cultural barriers like trust and risk perception may hamper community adoption of techniques like seismic retrofitting [30].

Some research suggests that the community-based approach can reduce costs, though more often it seems to simply shift costs from private profit to community capacity building activities. When community members volunteer labor or when local builders lead the school construction, contractor overheads, profit, liability insurance, and bank guarantees may be eliminated from project costs. However, project managers may have to account for higher costs in orienting, training, and overseeing local community members [29]. Yet, even with a financially neutral outcome, other authors have argued that a community-based approach bring other benefits. It can also increase community stewardship of the school. In some context, communities prefer to be involved in the entire process rather than see construction
handed over to outside contractors [24,26].

In this article we examine the challenges and potential benefits of community-built schools in areas with high exposure to natural hazards. We find that community-based school construction projects can create unsafe schools – schools liable to damage, collapse or becoming unusable during disasters – due to a host of challenges in the planning, design, construction, and completion of these schools. These community-based school construction projects may literally build in vulnerability to future hazards. Yet, with training, technical support, and oversight, community-based projects can result in school facilities able to withstand hazards and projects that bring secondary benefits. Community engagement in school construction may increase risk awareness, improve community commitment and capacity to maintain these schools, and enhance a sense of common purpose. The approach may also introduce hazard-resistant construction techniques, potentially increasing potential adoption of these techniques in private housing construction.

Below we summarize the qualitative methods we use to elicit a better understanding of this mode of school construction and then discuss a range of challenges. We then discuss some of the benefits and reasons practitioners advocate for community-based approaches. We conclude with a discussion of several principles that can guide community-based school construction.

2. Methods

In 2014, the authors sought to develop a better understanding of community-based school construction and articulate strategies for ensuring such schools were safe. We relied upon the Comprehensive School Safety (CSS) Framework – first adopted by non-governmental and United Nations organizations in 2013 and later updated and adopted by the Global Alliance for Disaster Risk Reduction and Resilience in the Education Sector (GADRRRES) in 2015 – to define school safety as practices that support CSS Framework goals. These goals are to protect school occupants from injury and death, support educational continuity, protect physical assets such as facilities, and strengthen risk reduction and resilience education within schools.

To understand better how community-built school construction projects could result in safer schools, we sought out the experience of field practitioners who were global experts in community-based school construction. Using our professional networks, we identified individuals and organizations engaged in community-based school construction in hazardous areas. We also used a snowballing technique to identify those outside of our collective networks. In total, we contacted 51 individuals. They included field architects, engineers, and program managers in NGOs and NGOs; others were program managers in national agencies or multilateral organizations involved in school construction. Of those contacted, 39 agreed to be interviewed and recorded via online video or audio calls, in some cases multiple times. They worked in countries in South, Central, and Southeast Asia; East, West and Central Africa; and in Central and South America and the Caribbean. Several of these global experts, which we refer to as practitioners below, had worked in multiple countries and even on multiple continents.

We also used an online survey tool to seek insights from technical experts in hazard-resistant school construction through UNESCO’s networks of scientific and research institutions such as the International Platform for Reducing Earthquake Disaster (IPRED) and the Reducing Earthquake Losses (REL) scientific program. Of the 24 invited to take part in the online survey, 19 responded.

The interview instrument and online survey included semi-structured and open-ended questions that explored the role communities played in school construction in the regions where the interviewees worked on community-based school construction. We asked about poor and good practices in seven broad phases or aspects – the project identification and planning phase, design and construction phase, oversight and decision making, community capacity building task, and sustainability and replicability. Standard processes of informed consent and protecting respondent identity were followed through an approved human subjects protocol.

The first two authors conducted the interviews and research assistance then transcribed each interview. We used a grounded theory approach to identifying and code key themes in the transcripts using qualitative analysis software. We identified 21 themes in the transcripts and survey responses, twelve of which were especially prevalent. The following three sections discuss types of community-based school construction, its challenges, and benefits based upon themes that emerged in the interviews and survey responses. Where we directly quote a practitioner, we follow the quote with a parenthetical including the interviewee’s number and their region.

3. Community-based school construction processes

The 39 global experts interviewed and 19 technical experts surveyed described their deep, and varied experiences of community-based school construction projects and programs across much of Asia, sub-Saharan Africa, and Latin America and the Caribbean. All incorporated some element of community involvement, however the scope, scale and the degree to which communities initiate and participate in the school construction differed greatly.

Some practitioners described community-based school construction without integration into government planning processes. For example, practitioners described small, often faith-based, organizations “sponsoring” children in a village or a foreigner making a connection with a community and raising funds to donate to the community for construction of a school. Using funds from these sponsorships or donations, community leaders bought materials and construct a school. In such instances, “there was no donor scrutiny at all” (5, Caribbean). Others described NGOs that hired a construction manager or architect as a project manager to oversee the construction of one or more schools, based upon the desires of donor. “I designed a building and was on site from beginning to end, but didn’t have any control over any of the money. … I was dealing with one women in New York who would call for updates and a guy who was a guide but never there” (35, East Africa). To address hazard resistance, this same practitioner explained they had connections with engineers in Western countries who would “sit down during their lunch hour and bang out some answers for us.”

In some countries, identification of the need for new or expanded schools fell to individual communities, especially in rural and remote regions of low-income countries. In one country, villages formed school management committees and identified the need, including “number of students in the school, and based on that, the number of classrooms needed” (10, South Asia). These committees also provided further oversight and guidance during the design process, such as deciding the site, building orientation, and materials. While the government sometimes provided funding to hire a contractor for building the school, often the community provided a substantial portion of the funds themselves, as well as contributed manual labor.

Practitioners also described projects were the community itself decided to prioritize school construction. One organization in East Africa, for example, hosted a request for community proposals in a large informal settlement. The organization then selected proposals that could best describe a site, vision, and social benefit. Whether residents proposed a school, a community center, bridge, latrines or other project, the organization then facilitates formal meetings with stakeholders, from government officials to local gangs. Together, stakeholders co-sign an agreement that ensures “the projects start out on the right foot, because it’s the community that puts the first foot forward” (35, East Africa). After such formalized community agreements, the organization provides funds and technical support for the project.

When school construction was linked to expansion of educational access, such as through the Education for All effort during the MDG period, or when school construction was linked to reconstruction of
educational facilities after a major disaster, Ministries of Education (MOEs) or other national ministries, along with their sub-national or district level departments, were more directly involved in planning and overseeing, if not funding, school construction. Local schools in one South Asian country would send “requests to the government through the district offices” (10, South Asia), which then prioritized projects and provided funds for construction of classrooms. This funding sometimes had external origins, such as in multiple countries in Central Africa where “basically the funds [go] from donor to the government to a contractor to be built” or the MoE directs construction “through various funding channels” (12, Central Africa). However, local communities in some South Asian contexts may also raise funds to expand the government-sanctioned project by collecting “money by donation or from other well-wishers” (10, South Asia).

The scale of some education expansion programs necessitated a mix of community participation with other, rapid-paced construction strategies. In one remote area of Central Africa, a large international agency did “construction through contractors but the planning through community participation” (12, Central Africa). In a number of countries, MoEs released a small number of prototype school designs, expecting communities to conform to these designs. During construction, local residents contributed labor (3, Southeast Asia; 38, South Asia), but in at least one case, the government “mobilized prisoners to do the construction” (12, Central Africa). Whether internally or externally funded, constructed by local builders or external contractors, it is often the education department staff within local governments or education-related program officers within INGOs who managed these extensive infrastructure expansion projects, in ways that vastly exceeds their training, roles and responsibilities. As one practitioner put it, the process is like “we’re saying, OK teachers, make yourselves into a construction professional overnight” (12, Central Africa).

4. Challenges of community-based school construction

Whether community-based construction starts with community-identified needs or through large-scale infrastructure expansion programs, the role of communities in the planning, design, construction and long-term oversight of the school facility creates pitfalls that can result in facilities at risk of damage and even collapse from natural hazards. These pitfalls include local understanding of risk, site selection, planning and design for hazard resistance, poor construction, insufficient training of local people, and poorly executed completion, each of which is discussed below. One of the initial challenges is risk awareness during site selection, discussed next.

4.1. Risk perception and site selection

Building safer schools requires that school facilities be sited in areas with as little hazard exposure as possible, that exposure to site specific hazards be reduced through physical planning of the site and civil engineering mitigation methods, and that the design of the school addresses any residual risk. Yet in selecting a site, hazard exposure must be balanced against site availability, cost, access, and the safety and distance of school-to-home routes.

Hazards may include acute natural hazards, such as in one mountainous country where all potential sites are “on a 45° slope in an earthquake zone” (46, South Asia) or where “the whole place is flood prone” (17, Southeast Asia). Hazards may also be chronic, such as one site where a sewage outlet drained into a fetid swamp or sites where households would be unwilling to send their children due to a lack of water for drinking and sanitation. Even some initially safe sites can become hazardous over time. As one practitioner explained, “there’s been massive deforestation in the last couple of years. Even schools built in appropriate places are now …exposed” (14, Southeast Asia).

In the context of community-based school construction, community risk awareness is often based upon local experience, rather than quantitative risk assessment. Local knowledge, being based upon direct experience and observation, may be particularly attuned to frequent hazards, such that “a community facing constant flood risk may understand flood risk to some extent…. [locals] can contribute probably what happened 10 years ago, maybe 15 years ago” (14, Southeast Asia).

This local knowledge can be invaluable. At one East African site next to a river, local residents knew it flooded twice a year and were able to show the practitioner the height of typical flooding. Without other hydrological data, the manager incorporated this best available knowledge into design calculations (35, East Africa). Yet, local residents may be less familiar with or unaware of larger magnitude, infrequent events or cascading events that may follow such extreme events. Considering again riverine flooding, another practitioner said that while local knowledge explains average flood heights, “they cannot really understand how far they should build from the river” (14, Southeast Asia).

Changes in the seasonality, frequency, and/or intensity of hydro-meteorological hazards, which are now directly attributed to human-induced increases in atmospheric concentrations of greenhouse gases, is also making it harder for local residents to use past experience as a guide to the future [32].

For infrequent hazards – for example, earthquakes and tsunami – local knowledge may be completely lacking, other than murky stories that are passed down through generations. Even where events are within collective memory, changes in construction practices and settlement patterns may mean that future impacts may be different than past experience. As one practitioner explained, “people don’t really have any sense of what could happen” (14, Southeast Asia). Local people themselves may, in fact, vastly overestimate how much the local community understands all of their risk.

Local people may also deliberately downplay or accept risks. Locals that have invested in a particular place may be reluctant to hear that their community is at the base of a slope that may fail or along a coastline that could experience towering tsunami waves. They may not want to know that the construction typology in which they live is fragile and liable to collapse in a cyclone or earthquake. Or, they may view this risk as inevitable. As one practitioner noted, “They are aware of their risks, but they believe if something is meant to happen, it will; they don’t believe any amount of precaution will be enough” (1, Central Asia).

Local residents may consider natural hazards a low priority in the first place. A practitioner who had worked in several countries in South East and South Asia, explained that the experience of living with a low-probability risk, often without harm due to the infrequent nature of the hazard, may lead local people to say ‘we can take the risk’ (14) or to insist that a hazard-resistant school design is unnecessary. As another practitioner noted, “Communities are largely demanding schools or classrooms, whatever way or whatever quality, [because] they have an acute need and so… they are more than happy to receive [any school]” (10, South Asia). In contexts of acute need and infrequent or changing hazards, local people may feel comfortable replicating the risky site and design choices they made for their own housing during a school construction project.

Yet low risk awareness is not limited to communities. One practitioner noted that educational teams visiting communities may pick sites without full understanding of hazard exposure, especially when sites were selected before technical and design review. In one instance, a community cleared a whole site that an educational team had identified, to then have the technical design team tell them that only a small corner of the site was a viable type for construction (46, South Asia).

Some practitioners saw community involvement in site selection as resulting in poor sites, others saw the opposite. “ask community[es] to give land, and they give that which cannot be used for any [other] purpose” (3, South Asia), one practitioner quipped. In Central America, wealthy land owners may donate land, but retain title to the land; they can “pull the plug at the drop of a hat” (49) and undermine investments made to the site or facilities on it. Other practitioners suggested that community choices may be more constrained than practitioners would
like. Village governments may have little choice but to offer land that is “on a cliff or something – it’s obvious the community doesn’t have much say in the site selection” (14, Southeast Asia). For others, local site selection led to safer sites because local residents were more aware of their environment. One practitioner explained that when “school planning is made at national level, there is more risk [but] where school facilities are managed at the municipal levels [schools] are at good sites [because] the communities know the risks (51, South America). Another noted, communities “want their [schools] to be safe” (29, Southeast Asia) and when safe sites exist, communities may even designate what they believed to be their safest sites for school construction (authors’ observations).

In the challenges of finding appropriate and safer school sites, practitioners found ways to improve site selection by harnessing community engagement. In low-income and remote regions where community-based school construction is most likely to occur, high resolution hazard maps are not likely to exist. Local knowledge of where and when slopes fail or where floods and other hazards happen may be invaluable. It may also be a springboard for conversations about hazards with which local people have less specific knowledge or no familiarity at all. One practitioner found that “even though they haven’t had an earthquake, they have landslides every season…[and] we can use that as a back knowledge to build awareness of seismic safety” (4, South Asia).

Their experience with landslides sensitized them to the importance of a school safe from landslides, making them open to learning about strategies for building a seismic-resistant school. Together, the local people’s knowledge of frequent, local hazards and the practitioner’s knowledge of infrequent hazards provided a fuller understanding of safer sites.

4.2. Planning and designing for hazard-resistance

Where governments rely extensively on communities to plan school construction projects, school management committees make choices of building orientation, the presence and location of toilets and playgrounds, even the construction material to be used. While their intentions to provide educational access may be good, independent community planning and design can have profound impacts on the safety and hazard resistance of the finished school.

Local residents, even those that have experience building their own houses and hazard-resistant traditional community buildings, may not have technical knowledge about column dimensions, wall placement, or classroom size. Their unfamiliarity may be especially pronounced when school construction differs substantially from vernacular construction, the latter of which often rests upon careful observation of natural and built environment over multiple generations. As one practitioner stated, “The intention is good, but they do not know the proper design, the proper safety level for a school, so that is why there are lapses” (10, South Asia). Another practitioner explained how local residents would divide classrooms in half or use less space that the government required per child, especially in private schools. In other places, land scarcity forces communities to build multi-storey schools even when doing so exacerbates risk. Or, enrollment growth results in school management committees extending buildings or adding additional floors after design [27]. Efforts to squeeze in more children had, in some cases, significant implications for the load the school structural system must carry; it “made them weaker” said one practitioner (5, Caribbean). When school planning and design is done without any guidance, school management committees can easily and unknowingly prioritize the issues with which they are most familiar – cost and enrollment – over long-term structural integrity.

One of the most technical aspects of building schools to withstand hazards is the structural design process. Many communities have traditional building knowledge that incorporates hazard-resistant practices, especially for frequency hazards such as flood and wind. Yet, much of that knowledge is being lost in the “trend… now going for modern industrial construction” both in housing and school construction. This modern construction “looks safer, but it is status” that really drives the trend (4, South Asia). While post-disaster reconnaissance attests to how poorly modern, technical construction can perform, practitioners noted that traditional or vernacular construction was not consistently better. As one explained, “In some regions when you construct with earth it is safer. . . [but] some places have very unsafe vernacular” (50, South America). Even where traditional practices show hazard resistance, finding the skilled trades people still able to practice these techniques may be difficult. As one practitioner noted, “remind [ing] them that there was something you already knew… is a difficult process” (4, South Asia).

With the shift to modern materials and construction techniques, one practitioner noted, “Everybody – government, NGO, INGO, whatever – thought that the school was very simple, therefore they would build without any technical input” (3, South Asia). Even today, smaller organizations, such as NGOs and non-profits with limited construction experience, fail to consider the technical design process of schools where notable differences, like room size, the absence of cross walls, irregular plan, and multiple floors – may require more conservative use of materials than in housing construction. The schools one practitioner assessed in the Caribbean were built without engineering calculations, design drawings or construction oversight – “pretty much all of the things that shouldn’t happen” (5). As another practitioner explained, “NGOs are creating a school to address access issues, so they hire a local contractor who usually has no idea what he is doing, even at the level of basic engineering design” (14, South Asia). The results could be “really dodgy, clearly very bad design” (5, Caribbean). Without dedicated resources aimed at hazard-resistant school design, these practitioners saw school construction creating unsafe schools.

Given the potential for catastrophic loss of educational infrastructure, many MoEs and large INGOS with school construction programs, as well as donor organizations, have begun investing more systematically in hazard-informed designs that address education access and safety simultaneously. They have done so by more deliberately drawing upon engineering expertise early in the planning and design processes. Such hazard-informed designs adds marginally to the costs of construction but creates much larger cost savings if a hazard does strike. As one sub-national government practitioner recalled, “They did a cost allocation and assessment [and calculated an] 8% increase in costs, not much considering the infrastructure loss” (24, South Asia). The practitioner was able to return to the bank funding the school construction and received a loan increase to cover the cost of implementing earthquake-resistant design.

To address the need for better school design, many MoEs issue a limited number of prototype model designs and mandate that local communities build one of them. Some large INGOS do as well. Where local capacity to create robust and safe school designs is limited, these model designs provide important guidance and may provide the first engineered design a community has built. Yet, as one practitioner explained, those drawing up the design may have too little knowledge of hazard-resistant construction to properly design or oversee safer school construction. Designs may be adopted from other regions, with no thought to climatic differences and its effect on the functional performance of the school, its appropriateness, and material deterioration. Similarly, designs drawn up within MoEs may be appropriate for the skills and hazards in one part of a county, and inappropriate elsewhere (authors’ observations).

Practitioners were concerned about the one-size-fits-all approach that prototype design approaches required, especially when such designs failed to account for local materials, climate, and hazard conditions. An INGO program manager explained that, with only minor changes, they were “literally building what [governments] had in their own plans and replicating that everywhere” (38, East Africa). For several practitioners we interviewed, doing so was problematic. As one practitioner who worked in Central Asia, South and Southeast Asia and Africa stated, “It’s quite scary….ministries just reproducing the same design no
matter where it is. . . if it’s on a hillside, or if it’s in a flood area” (12). Adjusting building layout to conform to difficult sites, adjusting foundation dimensions to accommodate flood waters, even considering building orientation based upon prevailing winds was not possible, or not adequately considered, with these prototype designs. And, the outcome was simple – when local builders see problems with such standardized design, “People just change them and that can jeopardize the safety” (5, Caribbean). Despite being a vast improvement on constructing schools without technical design input, the practitioners we interviewed still raised concerns about template designs and the expectation that locals would be willing or able to follow them.

Practitioners spoke of school design processes that engaged school management committee and wider community in the process, after seeing how trying “new things for the community without having them involved. . . was not a success” (50, South America). In some cases, the practitioner had to limit design choices to non-structural aspects, such as “the style of windows, or whether they wanted to paint it or not” (35, East Africa). Other times they could engage more deeply in ways that shaped the form, function, safety and social acceptability of the school. In one context, a practitioner found that a community wanted a large gathering hall, but that a standard large hall would be unable to withstand the pressures of floodwaters. They negotiated an open-air pavilion instead (35, East Africa). In South America, another practitioner found that in a community where traditional housing was round, building a rectangular school was rejected. Over multiple discussions, the engineer, the elders who made decisions, and the younger people who would carry out the construction, agreed to a rectangular building with rounded corners and that this “changed the perception” and acceptance of the school (50, South America). In Central Asia, a practitioner described designing schools in areas with flood hazard, explaining that the designers asked communities to weigh tradeoffs between the land they chose and the size and cost of school construction before finalizing the design (33).

4.3. Community involvement in construction

Practitioners saw that contractors and local builders, and even school management committees, did not necessarily have the capacity or willingness to construct schools according to structural design documents that explicitly included calculations for hazard resistance. When planning, estimating cost, and even approving design, school management committees in South Asia may follow procedures meant to insure hazard resistance, “but when it comes to actual implementation, most of the time they compromise and [builders] construct their own way” (10). In frustration, practitioners explained that builders paid to construct a school according to an approved design “don’t even follow the type design; they do whatever they want. . . make fundamental changes that violate earthquake safety provisions” (10). While constructing the schools, they may “start to make this wider, put a door here, and there” (49, Central America). The design is not implemented as intended and the result is, as one practitioner working in Southeast Asia explained, “absolutely no control” (14). Some of these changes are meant to cut costs and “save some money” (10, South Asia), but they also reduce the strength of the school building.

Practitioners noted that even when contractors or local builders attempt to follow design specifications, their unfamiliarity with hazard-informed designs and construction techniques hamper their ability to comply with design. Local builders, school management committees and the wider community are often unfamiliar with technical design drawings and may have low general literacy. When low-skilled workforces encounter technical drawings of unfamiliar construction techniques, they may simply do what they are used to doing, rather than attempting to decipher the drawings (authors’ observations). When the design calls for concrete construction, local builders may not have experience with steel detailing or with prescribed concrete mixture and cement ratios. When materials arrived on site, those on the school management committee and even local builders may not be able to verify quality. As one practitioner said with frustration, “Who really understands what a quality piece of timber looks like? Who is looking at the specification of the building? In some cases it is so basic that nobody is checking” (38, East Africa).

While governments and organizations often intend model designs as a means of standardizing and controlling school design quality, practitioners explained that “the community will decide what is available in terms of materials and what sort of concrete design and cement ratio” they will use, based upon “what is standard in their community, construction for housing” (14, South Asia). Without guidance and training, the result is unsafe school construction or newly built schools that must be torn down and restarted.

In community-based processes, even when program managers hire skilled contractors to carry out the build, these contractors use local laborers, even volunteers from amongst the parents, for much of the construction. The mason, day laborers, and volunteers they involve are most typically untrained, failing to “understand the intention behind the design” (10, South Asia). Local laborers and volunteers may unknowingly undermine the hazard-resistant aspects of the design, such as the water to cement ratios in the concrete mix or the need to keep concrete wet and, ideally, shaded during the curing process. Without constant oversight, without “making a relationship and visits” (46, global), practitioners found it hard to enforce design criteria.

Community-based school construction practitioners employed a variety of strategies to ensure design criteria were realized on the construction site. Some retained control over funding and construction oversight. For example, one practitioner said they retained control over “not only the cement mixture but the quantities of bags we purchased” (35, East Africa). Others used volunteers and direct community involvement in construction only on temporary learning spaces, but employed experienced, often external, contractors for permanent school construction. Where local capacity was low, some practitioners had their organizations build technical parts of the project, like septic tanks and electrical wiring, while encouraging community involvement in tasks that did not directly relate to the hazard-resistance of the school, such as painting and plastering. One practitioner found that local residents could participate in the fabrication of “local brackets and straps” for cyclone resistance (25, Caribbean). Others did support direct community involvement in the construction by using pictorial representations of design drawings and important step-by-step processes, such as concrete mixing or making of soil blocks. Still others used scale models as an effective strategy for helping local residents understand how to do hazard-resistant school construction. This practitioner summed up the strategy saying, “The danger with [design] manuals was that they were our language” (25, Caribbean). They combined these strategies with ongoing oversight by someone with the ability to interpret design drawings.

4.4. Community training

Community training was one of the most prominent strategies for increasing construction quality. Rather than trying to limit community involvement during the construction phase, some practitioners argued for increasing their engagement with local laborers, builders, residents and school management committees. Some trained in-country engineers and architects in hazard-informed approaches to designs, then entrusted them to train others, including local contractors. Other practitioners held orientations at each stage of the school construction process to review activities, responsibilities, provide transparency, and reiterate basic principles, such as construction safety, hazard-resistance, and prohibitions against child labor. One practitioner explained that while they did not employ locals in technical aspects of the construction, they did hold weekly “demonstration days [where] the community comes and asks why the technical folks are doing what they are doing” (3, South Asia).
Practitioners needed to be explicit about the implications of training of masons and local labor. While many practitioners, even their program managers and donors, saw the hiring of local skilled and unskilled labor as bringing economic benefit to a community, project budgets and plans might overlook the need to train these local laborers. Furthermore, contractors may not “see it as their roll to try and train community members. . . . [as their] responsibility [is] to finish on time and on budget” (38, global). Without careful planning, training and incorporating local laborers into school projects contracted out may fail to occur or be perfunctory at best.

Over and over again, practitioners pointed to both the role communities could play in construction oversight and the limitations of their ability to perform this role. In both large-scale school construction programs and in remote projects, hiring professional construction managers with engineering training on staff. Often they points local people become an important and continuous oversight programs and in remote projects, hiring professional construction managers to remain onsite continuously or having government officials frequently assess sites is costly or impractical due to a dearth of qualified professionals. As one practitioner with extensive experience in South and Southeast Asia explained, “The engineer may come one day and it looks fine, but come back for the second inspection and the slab is already cast and it’s like one more school down the drain in terms of disaster risk management” (14).

In these contexts, training communities to support construction oversight can provide an important layer of quality control. One practitioner laid out the options as “Either you put money into hiring more engineers, or you train community focal points [and provide] good communication lines back to base” (38, global). With trained focal points local people become an important and continuous oversight mechanism.

Practitioners described a multitude of strategies for training and empowering community focal points to support construction oversight. Most practitioners described having highly qualified and seasoned construction managers with engineering training on staff. Often they covered a large number of school construction sites over a wide geographic area. At each site, community focal points – school management committees, parents, community leaders or volunteers – were trained to act as daily construction monitors. These focal points had the power to stop construction. Practitioners gave focal points clear checklists of dangerous construction practices, telling the focal points to immediately contact them if they observe any of these practices (24, South Asia). An important aspect of the system was also “giving them some means of communicating with us [like] paying for a mobile phone for a period of time” (38, global). With advanced technologies for taking and sending digital photos and messages, trained local focal points can support remote monitoring. They can help ensure material quality and workmanship even when the construction manager is away or cannot reach sites due to security or other concerns.

Such community monitoring provided clear benefit. One such system in East Africa stopped unsafe construction:

“There were actually people coming forward who actually stopped one [school construction] site from going ahead altogether, which was fantastic. Because this contractor was taking the piss, he really was. He was doing nothing. He just had the worst quality materials. The community actually stopped this guy on site and told him to get off. You cannot build with this size of timber. This is fine for a house but not for a large structure. So they totally got that the quality of the materials was worth insisting on. They totally brought that site to a complete stop” (38).

One of the largest challenges practitioners say they face in instituting more construction monitoring, whether through hiring more engineers for construction compliance or by training community focal points to support day-to-day monitoring, is funding. Several practitioners stressed how difficult it was to get adequate oversight, one practitioner responsible for oversight of school construction globally stated, “There is often not enough people to watch the construction to make sure it is built to standard” (46, global). The problem starts at the proposal stage as proposal writers, often education specialists in government or IGNOs, do not put “much thought to who is going to supervise and manage the construction” (46). Monitoring was not included as an itemized budget line because construction specialists were often brought after the proposals and budgets have been finalized. The INGO in which this practitioner worked was discussing making it mandatory for construction teams to provide input before school construction proposals were submitted for funding (46). The emerging endorsement among donors and development partners for mandatory construction supervision overhead is a promising development (authors’ observations). Such efforts need to be paralleled by financial and technical support to develop and institutionalize local and national systems for code development and enforcement.

4.5. Completion

Even when practitioners spoke of successful community partnerships in sites selection, design, and construction, practitioners spoke of poor outcomes due to an overlooked or ill-conceived completion. Some practitioners noted that their organizations or government agencies made final payments without a final inspection. They also confessed that only rarely did project completion include the development of a maintenance plan and a safe use manual. As one practitioner explained, “Very few engineers have been required to put together a maintenance manual in previous private sector jobs” (38). In the context of community-based school projects, the school management committee, parents, and/or school staff are left responsible for the upkeep and use of the school after project completion. In some contexts, ongoing maintenance may be a cultural norm. For example, a practitioner who worked in East and Central Africa explained, “Every two weeks on a Saturday morning they have community work, so a lot of weeding, making fences and digging drainage work gets done by the community” (12). Yet, even they may have little training and funds to adequately maintain their school facility.

A lack of maintenance and use planning can undermine the long-term hazard resistance of a school. As one practitioner who had worked in several regions explained, “If you don’t maintain it, it will deteriorate more quickly, common sense…[we] need to make sure the school puts aside money for maintenance each year” (46, global). Yet, funding is not the only issue. Design teams often have little understanding of how community schools will be managed and maintained; they may not select materials with long-term community maintenance in mind. Without a funding strategy and guidance for optimal maintenance, school management committees may experience large maintenance tasks as unanticipated costs, even in contexts where community work is the norm. When the school building needs more expensive maintenance and no funds have been set aside, “They will go to the parents and ask for help in creating the roof, but who’s going to construct it? The result is a lot of informal modifications” (49, Central America).

School maintenance can also cause confusion of responsibility after project completion. One practitioner revisited a completed site, only to find that the design team had failed to give the school management committee a maintenance manual at handover. The practitioner discovered minor problems like “water leakage, downpipe brackets breaking, and solar panels not being erected correctly and no training given to maintaining them” (38, Southeast Asia). If the school management committee did not address these small problems, they could become “far bigger issues” (38). Another practitioner explained that school management committees needed a maintenance matrix – something that defined what tasks needed to be performed, when, and by whom. This matrix helps define what tasks were the community’s responsibility and what tasks needed technical oversight. The practitioner explained, “So if the toilets are blocked, you call the plumber and here’s the number. If the wall starts cracking then you absolutely call us. This
helps the community understand if they will have to use their saving or if they should contact the NGO” (35, East Africa). Without such plans, a school that is safe at handover, can become dangerous over time.

4.6. Benefits of community-based school construction

Despite the challenges that accompany community-based school construction – especially projects that incorporate safer school sites, hazard-informed design and construction, and long-term maintenance of these safer schools – practitioners were extraordinarily hopeful. Many saw community-based projects as creating, or potentially creating, long-term positive benefits for students, staff, and the broader community.

A practitioner with global experience found that community-based school construction projects took no longer than contractor-based construction, due to the frequent delays on contracted projects. Construction quality also was similar. However, the community-based project created better community cohesion and a strong sense of community ownership, a finding that has been seen elsewhere in the literature [33]. They also found that community-based approaches avoided conflicts between local labor and contractors that failed to train or pay local labor (38, global).

Community engagement also seemed to increase local capacity for school stewardship and advocacy for their needs. As one practitioner noted, “When government builds the school and … it breaks, the community doesn’t repair or do any maintenance to it because they think the school doesn’t belong to them. When they think it is theirs, they continue to monitor and maintain it” (129, South and Southeast Asia). One practitioner noted that school management committees, even local parents, became better connected to education sector governmental structures. During the planning stage, this practitioner said that meetings between local committees and the education sector officials helped ensure the community knew how to advocate for their school. It showed local communities “who is in charge – if your teachers don’t get paid, if your teachers need books, chalk, pencils, or whatever” (35, East Africa).

Community-based approaches also ensured that extra-curricular activities and school uses were integrated into the design and use of the school. When communities identify uses like evacuation and community centers for their school, it becomes “easier to knit [school construction projects] with evacuation planning” (12, East Africa).

Most importantly, practitioners hoped that community-based approaches would lead to direct knowledge transfer of hazard-resistant construction practices. Because schools were connected to a broad swath of a community, schools could “be a model for the rest of the community.” “We will slowly shift all the know ledge from the school to the community” (14) explained a practitioner who had worked in South and Southeast Asia. With this goal in mind, a practitioner who worked in East and Central Africa included hazard-resistant construction techniques in schools “so then people learn from it” (12). However, two practitioners working in Southeast Asia and Central Africa remained wary of simply assuming such technology transfer was occurring (14, 12). They questioned whether “it would actually work out [when] quite different typologies” (12) existed between housing and school building configuration and size. Other practitioners highlighted the importance of designing and constructing schools with locally familiar materials to reduce this difference in typology and allow the school construction to both raise awareness and provide concrete examples of relevant hazard-resistant technologies for housing.

Some practitioners did attest to knowledge transfer, in both direct and indirect ways. One practitioner saw direct knowledge transfer of the use of bonded masonry for earthquake-resistance, saying “I saw a building under construction with the bands … and the mason said they got training from one of the INGOS. He was using that knowledge” (3, South Asia). In a cyclone hazard context in South Asia, another practitioner observed, “Small ascetic points like lining terrace roofs to lessen [rainwater] seepage [occurred] because the masons picked it up and transferred it to their new clients” (4). Elsewhere, practitioners saw that “people involved in school construction are now a great support for building code implementation in the municipality” (10, South Asia). Another practitioner saw the benefit of heightened community risk awareness; it helped support institutionalization of “disaster management side and evacuation. . . drills.” (12, East Africa). Thus, these community-based projects had the potential to support not only the first pillar of the CSS Framework (Safe Learning Facilities), but to overlap with the second (School Disaster Management) and third pillar (Risk Reduction and Resilience Education) as well. When safer school construction was not seen in isolation from the broader CSS framework, these projects left communities better positioned to understand and demand safer construction practices and to value and support school and community disaster management.

Achieving technology transfer during community-based, risk-aware school construction was not inherent. As one practitioner explained, “If we want technology transfer through school construction, there should be a way to train, so the through the process itself, the technical concepts will still be there [in the community]” (4, South Asia). This skills transfer depended significantly on the construction materials. “We shouldn’t be designing with materials that are not [locally] accessible,” said one practitioner speaking of work in the Caribbean. Design choices of unfamiliar materials and techniques can “give an impossible [disaster risk reduction] DRR message” to the community. Rather, this practitioner argued, “We’re aiming at high standards of safety and certainly much safer than what was there before, but also something that can be replicated” (5, Caribbean).

Practitioners also cautioned against the impulse to train and engage communities without a clear purpose and long-term continuity strategy. Trainings, orientations and other forms of community engagement needed “a certain purpose. . . not to do training for the sake of training” (12, East Africa). Rather, training needed to be tied to what local people were willing to contribute. “If they say ‘OK, this is my contribution to the process,’ then we give him [sic] the right amount of training for that” (12). Other practitioners echoed this sentiment. One practitioner in South Asia stated, “You can’t just be dictating involvement from the top; we can do things to include communities in areas where they feel comfortable and they come forward to participate.” Training communities to take on tasks for which they saw no need, saw the responsibility as belonging elsewhere, or for which they did not feel capable, was “not very successful” (4, South Asia).

Practitioners saw targeted community engagement – training and capacity building in areas of felt need – as part of a long-term strategy. Doing so engaged the broader community so that they were “at least oriented on such aspects then gradually they can demand greater safety” (10, South Asia). Such engagement would create grassroots “demand for better quality construction” (10). Targeted Mason training and community orientations helped support a risk-aware culture where local people knew how to “hire a proper mason” (3, South Asia) and where people were willing to pay a premium for masons with higher training in hazard-resistant construction techniques. Similarly, practitioners spoke of long-term strategies for engaging children and youth at school, such that one that said “each year trains the next year” (17, Southeast Asia) in risk awareness, school disaster management, and knowledge of the hazard-resistant construction built into the school. One practitioner noted that highlighting the hazard-resistant features of a school design, whether that be bracing, bands, elevated floors or drainage systems, helped institutionalize this knowledge and help sustain knowledge transfer to community and future generations.

Yet even as these practitioners spoke of the cascading benefits of community-based, hazard-resistant school construction, they saw this approach as specific to a stage of national development. In contexts where local people were unfamiliar with hazard-resistant construction, “community involvement and community awareness and that sort of stuff is good;” (10, South Asia) said one practitioner. However, even this practitioners looked forward to a time when hazard-resistant construction was a “more formalized institution” (10). This formalization process
required three prongs. Firstly, it required government-led building code adoption. It also required “national capacity building for masons . . . architectures and engineers” (14, Southeast Asia). Lastly, it required broad, defused knowledge that buildings constructed according to these codes were better; they would not collapse. Thus, another practitioner stated that “demand should be generated from the end-user . . . they should be the ones that demand better quality of construction” (24, South Asia).

4.7. Good practice for achieving safer school facilities

While, community-based approaches are no guarantee of safer schools [19,27], well-implemented community-based school construction could be remarkably successful. Interviews with 58 global experts on community-based school construction highlight the challenges of incorporating hazard-resistant construction techniques and risk-aware school site selection into this type of school construction projects. Yet these experts’ experiences also suggest that incorporating risk awareness, capacity building and technical oversight can support the safer site selection and successful integration of hazard-informed design and construction techniques into school construction projects. In some instances, community-based approaches can also enhance local capacity and commitment to maintaining school safety and may lead to the adoption of hazard-resistant construction techniques in the community.

Out of the experiences of the practitioners we interviewed, several hard-earned lessons seemed to emerge. Through an iterative consultation process with the practitioners, we drafted these lessons into the following seven principles, first published in Towards Safer School Construction: A Community-based Approach [25]:

- Build safer schools and strengthen weak ones. Schools must be planned, designed and constructed to protect students and staff. When existing schools facilities are unsafe, they need to be identified, prioritized and strengthened. Concern for community priorities, cost and time takes second place to safety, and all stakeholders must commit to ensuring safety through quality assurance. Building anything that does not meet these assurances risks lives and wastes development funds and community effort.

- Engage as partners. A community-based approach is premised on building consensus between the development actor/government body and the local community. Development actors and governments may be best positioned to provide knowledge of regional hazards, hazard-informed design and effective construction techniques. But communities will be more knowledgeable of local hazards, site conditions and material availability. They will also best understand local construction practices. Both parties need to learn from each other. Project implementers must avoid token participation. Rather, school communities should be empowered to be full partners in comprehensive school safety.

- Ensure technical oversight. While appropriate safer school construction enhances community capacity and transfers technology, technical oversight remains crucial. The development actor or government must ensure design and construction complies with good practice for hazard-resistant construction. Where technical capacity is low, they should also increase local technical capacity by connecting skilled labor and technical specialists from the community with external specialists.

- Build upon local knowledge. Safer school construction should build on local knowledge, not replace it. Site selection, design and construction should follow local practice, making only moderate adaptations to ensure safety. Doing so ensures communities can adapt good practices to existing ones and apply them elsewhere.

- Develop capacity and bolster livelihoods. Community-based safer school construction provides an important training ground for new skills. Projects should support training for skilled craftsmen and women who need to learn hazard-resistant construction techniques. Once trained, these craftspersons may even market their new skills.

Safe school projects may also be ideal for improving the skills of local government technical staff in hazard-resistant design and construction oversight. Their involvement in all projects – big and small – can spark interest in community-based approaches and further encourage governments to fulfill their obligation of providing safe schools to all communities. Good practice

- Support a culture of safety. Building safer schools provides a tangible project for increasing community awareness about hazards and risk-reduction strategies, and this awareness can be sustained and enhanced. Establishing school disaster management committees and integrating hazards and risk-reduction concepts into curricula can encourage everyone to regularly engage in school disaster risk reduction after construction is complete.

- Scale-up and promote accountability. Organizations and agencies engaging in community-based safer school construction should develop common standards, processes and guidance tools. This will allow successful aspects of the approach to spread. They can also make a public commitment to safer schools and track this commitment through measurable targets and indicators.

These above principles can help guide community-based school construction so that the resulting schools are better able to withstand hazards. In better withstanding hazards, these community-based schools help ensure children’s right to safety and survival. They also ensure children have continued access to education, even when hazards strike their community [34]. As one practitioner noted, “If we’re going to build schools . . . the end result should be sending our children to schools that are safe” (50, South America). Community-based safer school construction will not only advert the death, injury, education disruption, and school infrastructure losses seen in past decades, it will raise local capacity to better manage safer schools and continue disaster risk reduction within and beyond the school, even after construction is complete.

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Appendix A. Supplementary data

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References


