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Long-term evaluation of proactive attitudes toward disaster education in Nepal

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ABSTRACT

This study proposes a change in the approach to evaluating disaster risk reduction (DRR) education from short-term knowledge transfer to a long-term action-oriented approach. Furthermore, the study recommends introducing a chronological and progressive evaluation method that follows learners in DRR education from the beginning, rather than evaluating retrospectively. Thus, the study discusses the strong tendency in the literature toward the short-term knowledge-transfer evaluation paradigm and its problems from two viewpoints: inconsistency between what is evaluated and what needs to be achieved, and dissociation of knowledge from action. Three studies on long-term evaluation have solved these problems; however, they did not evaluate how the proactive attitude grows and is evoked. Thus, this study describes the chronological development of a DRR education exchange program between Nepalese and Japanese students and the progressive change in attitude of Nepalese students from 2001 to 2015. It was revealed that the education contributed to fostering the learners' proactive attitude, which they maintained even after graduation. The learners promoted the construction of earthquake-resistant houses in their village and contributed to decreasing structural damage sustained from the 2015 earthquake. More importantly, the study clarified that the learners' attitudes evolved to become proactive, and that this proactive attitude was maintained for more than 10 years throughout three phases: educational, participation, and independent action. The study recommends that researchers change their approach to evaluating DRR education to a long-term action-oriented approach. Accumulation of data for long-term action-oriented evaluation leads to the ability to explore an effective education methodology that fosters a proactive attitude in learners.

1. Introduction

Research on disaster risk reduction (DRR) education practices involves establishing cooperative relationships with schools and communities as well as designing, implementing, and evaluating educational programs. Current research on DRR education practices strongly emphasizes the importance of transferring knowledge from experts to the public [1–4]. This tendency is the result of a reliance in DRR education research on the so-called deficit model [5–8]. The authors of these studies point out that many DRR education studies are designed, carried out, and evaluated based on the deficit model with the fundamental premise that the public does not proactively take preparedness actions and respond appropriately because of a lack of knowledge, and thus experts need to transfer the appropriate disaster knowledge to the public. Muzenda-Mudavanhu [9] and Aghaei [10] reviewed recent DRR education-related studies and also confirmed that they focus on the transfer of knowledge from experts to the public. The current knowledge transfer paradigm in DRR education research produces two main tendencies in evaluations of DRR education [11,12]. First, the evaluation methodology tends to be a questionnaire survey comparing the pre-DRR education with post-DRR education to identify extent to which the knowledge gap between experts and the public has been closed. Second, DRR education interventions in schools and communities are evaluated over only the very short term. Consequently, long-term educational effects such as behavioral changes are seldom evaluated. The need for long-term evaluation using empirical evidence to determine whether DRR education contributes to reducing risk has been pointed out [11–14]. Thus, the principal objective of the present study is to discuss

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the drawbacks of the short-term knowledge-transfer paradigm and propose an evaluation approach that involves long-term educational interventions for evaluating actual behavioral changes in learners, which is called a long-term action-oriented evaluation.

This study first explains the strong tendency for studies to follow the short-term knowledge-transfer evaluation paradigm (Section 2.1). Second, fundamental drawbacks of short-term knowledge-transfer evaluation are discussed from two viewpoints: inconsistency between what is evaluated and what needs to be achieved, and dissociation of knowledge from action. This discussion helps to clarify the need for introducing a long-term action-oriented evaluation (Section 2.2). Third, we refer to three studies on the long-term action-oriented evaluation of DRR education to discuss the advantage of this type of evaluation (Section 3). These three studies successfully evaluated learners' proactive attitudes and their actual actions but did not evaluate how their proactive attitudes grew and were evoked throughout the DRR education process. Because these studies performed evaluations retrospectively, the researchers did not follow the DRR education process from the beginning but instead evaluated by looking back from the time of their studies. Such retrospective studies have some inherent limitations, such as the risk of recall bias and selection bias. Hence, fourth, in Section 4, we introduce a case study of a long-term action-oriented evaluation of DRR education provided throughout DRR education exchange programs between Bal Bikash Secondary School in Aalapot, Nepal and Maiko High School in Kobe, Japan, to describe the chronological development of DRR education and how the attitude of Nepalese learners progressively changed. A participant observation method was applied following annual DRR education exchange programs from 2001 to 2009 and follow-up interviews of Bal Bikash graduates after the 2015 Gorkha earthquake in Nepal. This long-term action-oriented evaluation affirmed the importance of evaluating the learners' actual actions as a result of a series of DRR education activities and the effect of actual earthquake risk reduction efforts during the 2015 Gorkha earthquake. Importantly, these outcomes cannot be evaluated with the short-term knowledge-transfer paradigm. Finally, we discuss the implications of long-term action-oriented evaluation for effective DRR education research.

2. Short-term knowledge-transfer evaluation paradigm and its problems

2.1. Current evaluation paradigm

As mentioned in the previous section, DRR education studies are designed, implemented, and evaluated based on the deficit model, which has resulted in the short-term knowledge-transfer evaluation paradigm. The following studies provides evidence to support this claim. Johnson et al. [11] methodologically reviewed DRR education evaluation. They extracted a large number of peer-reviewed articles as well as reports on DRR education by NGOs and international aid organizations. These documents were filtered using terms such as "evaluation," "children," and "disaster," and 38 were selected. These selected documents mainly focused on the analysis of educational effectiveness and clearly described the evaluation methodology. From these 38 documents, 35 cases of DRR education were examined because some documents discussed the same cases. Thus, 35 DRR education practices were conducted in the United States, Turkey, Nepal, Israel, and New Zealand, and through online learning. The researchers found that all but one of the cases evaluated DRR education based on short-term practices. The evaluation methods used for data collection were mostly quantitative questionnaire (22 cases, 63% of cases) and mixed methods questionnaire (7 cases, 20% of cases). The indicators in these questionnaires were knowledge of hazard risks, knowledge of emergency response, and knowledge of preparedness actions and resources. This review demonstrates that DRR education research relies upon evaluations of knowledge transfer, points out the lack of empirical and practical evidence of how DRR education influences learners' actual behaviors, and highlights the scarcity of long-term evaluations in the literature.

A similar tendency was observed in the Japanese research context. Chijiwa [15] reviewed 50 peer-reviewed journal articles and academic conference abstracts related to DRR education that were published in Japan between 1999 and 2016. Those 50 papers were extracted from the journal published by the Japanese Association of Safety Education (volumes 1–11), the journal published by the Japan Society for Natural Disaster Science (volumes 28–35), the Journal of Japan Society of Civil Engineering (volumes 67–72), conference abstracts published by the Japan Society for Disaster Information Studies (volumes 1–18), and conference abstracts published by the Architectural Institute of Japan 2011–2015. It was revealed that 72% of the studies presented research findings based on DRR education that was practiced for less than 1 week, 4% conducted DRR education that lasted less than 1 year, 14% lasted more than 1 year, and 10% did not identify duration. Chijiwa [15] also pointed out that 72% of the studies used a questionnaire survey as their evaluation methodology and predominantly introduced knowledge-based questions or questions inquiring changes of interests. Representative indicators used for evaluating DRR education are shown in Table 1. In addition, the criticism that DRR education studies evaluate only the short-term transfer of knowledge is also discussed by Ronan et al. [16] and Johnson et al. [17]. Ronan et al. [16] points out that the biggest issue in DRR education research is that "no child and family preparedness education program study to date has used a time series experimental strategy and followed cohorts into the response and recovery phases of a hazard event." Previous studies have clearly pointed out that DRR education research is too focused on short-term knowledge-based evaluations and make the case for long-term evaluations with empirical educational outcomes.

2.2. Fundamental issues with short-term knowledge-transfer evaluations

The short-term knowledge-transfer evaluation paradigm does not address the two fundamental issues that DRR education research faces. One is the inconsistency between what is evaluated by the knowledge-based indicators and what aims to achieve in DRR education from a methodological viewpoint. The other is the dissociation of knowledge from action from a practical viewpoint.

The inconsistency appears when the effectiveness of DRR education is verified based on the knowledge-based indicators. The objective of DRR education is often explained using terms such as behavioral changes, actions, and culture of safety (e.g., Ref. [18–21]. These terms indicate that DRR education is oriented toward bringing about behavioral changes in learners, promoting learners' preparedness actions, and

Table 1
Representative indicators used for DRR education evaluation (based on [11] and [15]).

Indicator	Examples of questions
Knowledge of hazard and risk	● Do you know the mechanism of earthquakes? ● Do you know the difference between the Japanese seismic intensity scale and magnitude?
Knowledge of emergency response	● What is the appropriate response for a specific disaster situation? ● What is the appropriate action when specific disaster information is issued?
Interest in disasters and DRR	● Were the DRR education classes interesting?
Dissemination among family members	● Did you discuss what you learned with family members? ● Was an emergency response plan drawn up at home?
Mental effects of DRR education	● After the DRR education classes, did you feel uneasy about disasters? ● After the DRR education classes, did you feel confident about responding appropriately to disasters?

DRR: disaster risk reduction.

cementing these behaviors into the learners' daily lives. However, the evaluation indicators often measure the extent of knowledge as mentioned above. Thus, achievement of actual action is intended, but only knowledge is evaluated. This implies that DRR education should intend to be evaluated by learners' actions as a result of DRR education to achieve the objectives of education.

The dissociation of knowledge from action refers to more practical but fundamental challenges, which means that, in contrast with the assumption of the deficit model, the amount of learners' knowledge does not necessarily correlate with an increase in preparedness actions. Shaw et al. [18] conducted a questionnaire survey with 1,065 high school students in Japan. The results showed that school education provided knowledge but did not promote the students' preparedness actions. Shiwaku et al. [22] surveyed five schools in Nepal and concluded that DRR education lectures at school did not lead students to take relevant measures. Osawa [23] also conceptually emphasized the dissociation of knowledge from action based on analyses of the 2011 Tohoku earthquake and tsunami, and the following Fukushima Daiichi nuclear disaster. Prior to the catastrophe, the Japanese people were knowledgeable of the logical probability of a 10-m-high tsunami or a nuclear accident occurring. Because this was recognized as probable but not as actual, countermeasures were not taken. This is an example of how knowledge and action are often dissociated. A similar finding was made by Wachinger [24]; who reviewed 35 risk perception studies and identified a paradox in which high risk perception does not directly correlate with a high level of preparedness behaviors. This study implied that research based on the short-term knowledge transfer is sufficient for developing DRR education methodologies to enhance the effectiveness of knowledge transfer; however, this knowledge transfer does not necessarily result in behavioral changes and appropriate responses in learners.

In solving the issues of inconsistency and dissociation, it is necessary to accumulate and analyze DRR education studies that evaluate learners' actual actions and behaviors. At the same time, it is important to cultivate a long-term attitude of implementing DRR education and evaluation. By doing so, diverse and innovative methods of DRR education may be suggested for effectively fostering a proactive attitude in learners. Thus, the approach of long-term action-oriented evaluation should be pursued.

3. Significance of long-term action-oriented evaluation

This section discusses how long-term action-oriented evaluations can overcome the drawbacks of short-term knowledge-transfer evaluations. Although there is a scarcity of long-term action-oriented evaluations of DRR education, we have identified three empirical examples. Here, we review those three studies and discuss the common contributions of the long-term perspectives.

Nakano et al. [25] conducted a follow-up survey of graduates of Maiko High School in Kobe, Japan to verify the effectiveness of the Environment and Disaster Mitigation Course curriculum. The course was established in 2002 with the aim of fostering citizens capable of leading disaster management at the community level. The study involved an online questionnaire survey of graduates 12 years after the establishment of the course. The survey targeted 378 graduates, with 10 years having passed since the oldest students graduated. In total, 112 responded. The survey covered the following three aspects: relationship of present job or study to disaster management, level of involvement in disaster-related activities after graduation, and influence of the course on career choice. The study revealed that 21% of respondents engaged in work directly related to disaster management, such as firefighter, NGO staff, or study on disaster-related topics at higher education institutions. In addition, 65% of the graduates linked their occupation with disaster management, such as a kindergarten teacher who taught about disaster response for children and implemented evacuation drills. The survey also revealed that 78% of graduates were voluntarily involved in disaster-related activities, even after graduation. The graduates held various activities, such as DRR education for children, volunteer work in disaster-affected areas, and participation in fund-raising activities for disaster-affected areas. The study attributed these practices over a prolonged period to two features of the course content. One was simulated experiences in high school, such as visiting disaster-affected areas and listening to the experiences of past earthquake survivors. The other was the opportunity for students to reflect on their learning in the actual field, such as delivering disaster education to neighboring school children, and volunteering in disaster-affected areas.

Jang et al. [26] studied the influences of the Boy Scouts experience in adolescence on adulthood in the United States. More specifically, differences in attitude toward social life between those who achieved Eagle Scout status (highest achievement) and lower-level Scouts, and between those who achieved Eagle Scout status and non-scouts. A questionnaire survey was conducted by telephone that was targeted at 134 Eagle Scouts, 853 lower-level Scouts, 1,502 non-scouts and 23 people who did not specify their status; the researchers attempted to contact 2,512 people in total. The mean age of the respondents was 47 (range 18–94) years. The survey consisted of seven interview components and a "Planning and Preparedness" component that included a series of questions related to disaster preparedness. The survey results clarified that Eagle Scouts gained significantly higher scores on certain statements in comparison with both lower-level Scouts and non-scouts. They tended to agree with the following: "a disaster supply kit is kept in home", "a kit with emergency supplies is kept in the car," "my family has a specific meeting place in the event of an emergency," and "I have CPR certification." Even though the impact of the Eagle Scout program was very positive, an analysis of factors that influenced attitude change was not included in the report.

Chijiwa [15] studied collaborative DRR education practices among an elementary school, the community, and local government in Okitsu, Kochi prefecture, Japan. Okitsu Elementary School holds DRR education classes for 5th and 6th grade students. This educational effort has continued for over 10 years since 2005 and the school, community, and local government in Okitsu collaborate to realize various educational and community-based activities. The study aimed to analyze the impact of the collaboration in the community and its impact on the graduates of the elementary school. Both quantitative and qualitative data were adopted to evaluate the impact of the collaboration. First, the participation rate in seven community tsunami evacuation drills was analyzed. The data used for the analysis included the attributes of individual community members so that changes in participation rate at the individual level could be tracked. Second, six graduates (aged 18–20 years) were also interviewed approximately 7–9 years since graduating. The study identified that this collaboration realized a cycle in which students find risks in the community (e.g., creation of a safety map), then they communicate these risks to the community members, and improvements or risk reduction activities are made by the local government (e.g., installation of luminous evacuation signs for night evacuation). The study also showed that continuous DRR education practices at elementary school increased participation rates in evacuation drills, with families who lived with elementary school students more likely to participate. The interview clarified that the students' awareness of tsunami disasters was maintained even after approximately 7–9 years since graduation. In addition, one graduate worked in the disaster management division of the local government, one chose to study DRR at university, and another chose to enter the Japan Self-Defense Forces. It is worth mentioning that many people who enlist in the Japan Self-Defense Forces are motivated to join because they want to work in areas affected by natural disasters.

The three case studies mentioned above are examples of long-term action-oriented evaluation and achieved to evaluate actual actions carried out by learners, not knowledge. The Maiko High School and Okitsu Elementary School studies showed that some graduates chose a DRR-associated career. Furthermore, 78% of the Maiko graduates were

voluntarily involved in DRR-related activities after graduation. The Boy Scouts study showed that learners maintained a high level of preparedness, with emergency kits and supplies prepared and a meeting place in case of emergency decided upon by their family. These findings are unique and distinct from the findings of knowledge-centered short-term evaluations.

Further study of long-term action-oriented evaluation is required to propose indicators and methodologies that promote a proactive attitude, continuous awareness, and actions in the long term. However, the three case studies presented above commonly implied three aspects. First, continuous DRR education intervention is required to evoke actions and behavioral changes rather than single DRR education practice. This is evidenced by how Maiko offers 3 years of DRR education, Okitsu Elementary School mandates 2 years of DRR education for 5th and 6th grade students, and Boy Scouts offers experiences throughout adolescence. Second, all three case studies included opportunities for learners to contribute to the community. In other words, they took action as a part of learning. The Maiko students received DRR education for neighboring schools and worked in disaster-affected areas. The Okitsu Elementary School students elaborated on a risk map and took DRR countermeasures based on the risk map by collaborating with stakeholders, such as the installation of luminous signs. In the Boy Scouts case study, to obtain the status of Eagle Scout, Scouts need to launch a project that contributes to the community. Third, none of the studies emphasized the role of knowledge in DRR education. Even though many classes at Maiko High School involved transfer of knowledge related to disaster management, graduates were instead strongly influenced by the vivid stories of those who worked and volunteered in disaster-affected areas. In the Boy Scouts case study, although the analysis was not detailed, the Boy Scouts of America website (date not specified) states "Scouting is the ultimate form of learning by doing" and the Scout Motto is "Be Prepared." Thus, it emphasizes the importance of learning by action, not mere transfer of knowledge. These three case studies of long-term evaluation allow visualization of DRR education that could influence career development (Maiko High School and Okitsu Elementary School), and lead to continual preparedness actions (Boy Scouts). Furthermore, graduates of Maiko High School maintained active participation in DRR-related activities.

The three above case studies evaluated learners' attitudes as a result of DRR education from a long-term perspective and overcame the inconsistency and dissociation produced by short-term knowledge-transfer evaluations. However, they could not clarify the transition process for fostering the learners' proactive attitudes during each phase of DRR education. Because these case studies were evaluated from a retrospective viewpoint, the researchers did not follow the process of DRR education from the beginning and evaluated by looking back at the time of their studies. To increase the value of long-term action-oriented evaluation, it is important to document DRR education activities progressively and chronologically in the long term, which also provides insight into the accumulative process of DRR education and learners' attitude changes. Hence, the next section presents this new challenge of DRR education evaluation by describing the annual DRR education activities and proactive attitudes among the students of Bal Bikash Secondary School, Aalapot, Nepal, from 2001 to 2015.

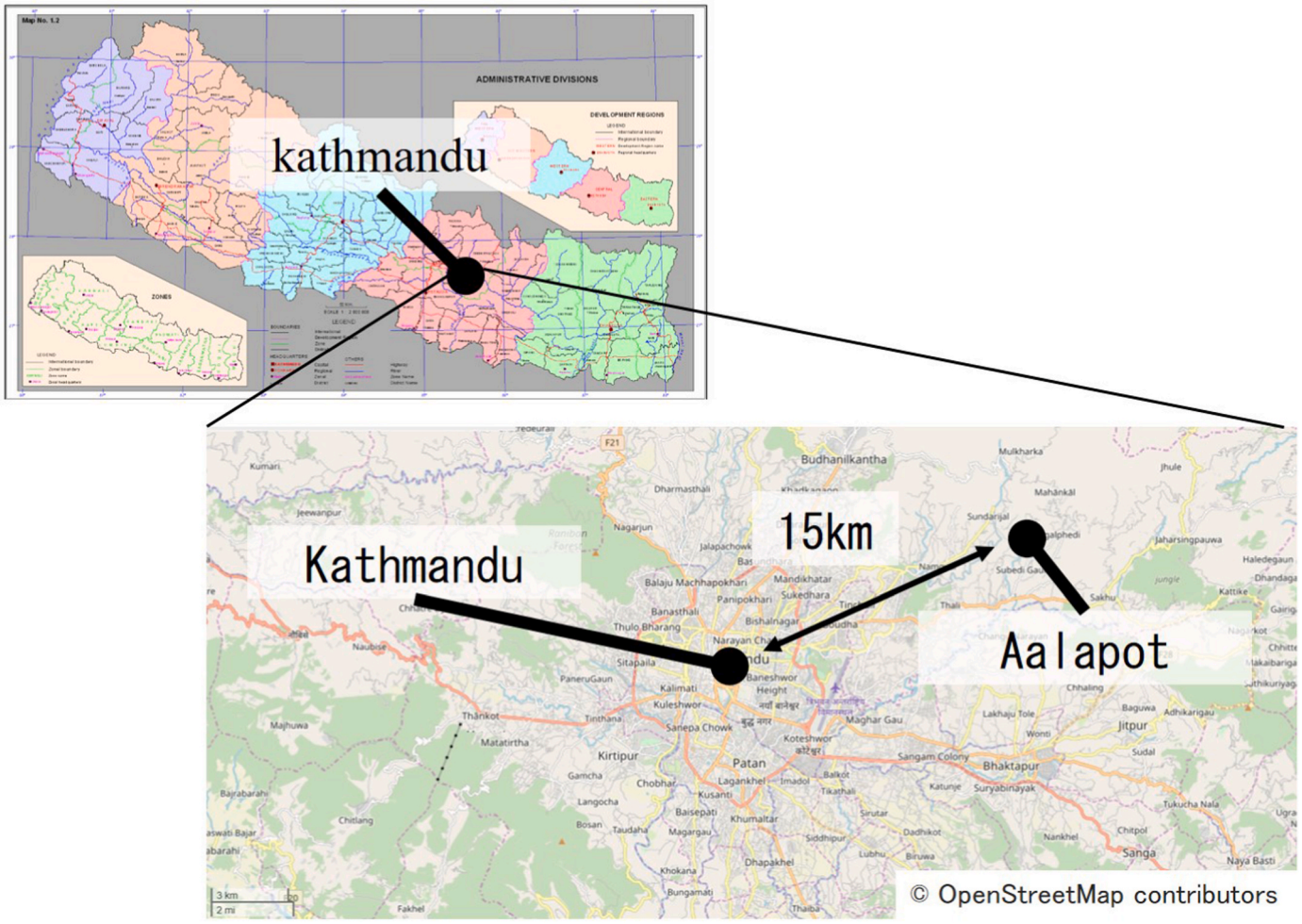

Fig. 1. Map of Nepal (left [27], and location of Aalapot village (right, OpenStreetMap).

4. Long-term evaluation of DRR education in Bal Bikash

4.1. Study area

A program of continuous DRR education and long-term evaluation was introduced at Bal Bikash Secondary School in the village of Aalapot (Fig. 1). Bal Bikash is a government-run school for 1st to 10th grade students. The school, which was founded in 1957, has approximately 200 students. Earthquake retrofitting of the school building was carried out by a local NGO in 2001.

The village is located in the northeast part of Kathmandu Valley at an altitude of 1,400 m above sea level, approximately 15 km from the center of the capital city, Kathmandu. At the time of the study, Aalapot consisted of 671 households with a population of 3,159 (Nepal government statistics, 2011). The north part of the village faces mountains with an altitude of 2,300 m. Thus, most of the village is on the plains of the Kathmandu Valley, with some steep mountainous slopes. Consequently, small scale landslides are a frequent occurrence in the rainy season. The risk of earthquakes is also high, and the Kathmandu Valley has been the site of many historical earthquakes, including the 1934 Bihar earthquake, the 1988 Nepal–India border earthquake, and the 2015 Gorkha earthquake.

The village was founded by masons and construction workers who migrated to the area in the 1950s to look for work. At present, residents both commute to Kathmandu and engage in agriculture, including rice and vegetable farming. When the study commenced in 2002, the roads were not paved, only two houses had a toilet, and only one house had an internet connection. Now, most of the main street is paved, and most homes have toilets. In addition, there is widespread use of cellular phones. Thus, the development of the village has also the progress during the present long-term study. The administrative unit of the village was reformed due to the adoption of a new constitution in Nepal in 2015. Currently, the village is formally located in ward no. 2 of the Kageshwari-Manohara municipality. However, because most of the study was conducted when the previous administrative unit existed, the following term is used, based on the former administrative unit: “Aalapot Village Development Committee.”

4.2. Study methodology

The study adopted the participant observation method from 2002 to 2009 to follow the DRR education activities at Bal Bikash chronologically as well as follow-up interviews to evaluate the effects of the DRR education program on the school’s graduates after the 2015 Gorkha earthquake. In the participant observation method, that the researchers are involved in the events and daily activities of the study participants to learn their life routines, customs, culture, and in the case of the present study, DRR education activities. This qualitative method involves collecting narrative data in natural settings through the use of open-ended interviews [28]. The participant observation method was originally applied in the field of anthropology; however, the method is currently used in various disciplines, including education and nursing [29,30].

Participant observation was conducted from 2002 to 2009. The authors’ relationship with Bal Bikash Secondary School began in 2002, one year after the abovementioned retrofit of the school building. The authors’ relationship with the school was initiated with the NGO’s launch of a DRR-oriented cultural exchange program between Bal Bikash Secondary School and Maiko High School in 2002. The first and second authors took the role of coordinating the exchange program on the Maiko side and accompanied the students on their exchange program visits. The exchange program also involved the organization of DRR education events such as a speech contest and student summit. The participant observation was conducted with a specific focus on the student members of the School Earthquake Safety Club (SESC) at Bal Bikash Secondary School because implementing DRR activities was part of the club’s activities. In fact, SESC activities were conducted mostly in conjunction with the exchange programs. Hence, the authors documented the SESC’s DRR education activities while accompanying the Maiko High School students on their exchange program visits each year. The Maiko High School students visited Bal Bikash Secondary School for about a week every August from 2002 to 2009 except for 2006 due to civil unrest in Nepal. As mentioned in Section 3, Maiko High School offers a course entitled Environment and Disaster Mitigation and all the students who visit Bal Bikash Secondary School take the course.

Follow-up interviews of Bal Bikash graduates who belonged to the SESC were conducted after the 2015 Gorkha earthquake to identify the effect of the SESC’s DRR education activities. Thirteen SESC members participated in both the exchange program and DRR education activities. By this time, most of the thirteen graduates had left the area and we were able to conduct interviews with only four former SESC members. Thus, the present study focuses specifically on these four ex-students. The interviews were held between May 2015 and November 2018 and consisted of three questions: 1) Since graduating from Bal Bikash Secondary School, have you been involved in any disaster-related activities? If so, what kind? 2) Between the time you graduated until the 2015 Gorkha earthquake, did you utilize the knowledge you learned from the exchange program and DDR education activities at your home, school, or community? If so, how? 3) How did your experience with disaster risk reduction education change/influence/impress you?

In the following sections, the four students are referred to as Students A, B, C, and D. Student A, female, the president of the SESC graduated in 2005; Student B, female, graduated in 2006; Student C, male, graduated in 2006; and Student D, male, graduated in 2007. Because all four students belonged to the SESC at the same time, they participated in most of the same activities. They graduated in 2005, 2006, or 2007. Hence, after 2005, individual descriptions of the students are given, including the results of their interviews after the 2015 Gorkha earthquake, to clarify their involvement in DRR education activities after graduation. In addition, some references are used to complement the description of DRR education activities.

4.3. DRR education in Bal Bikash

4.3.1. DRR education in 2001 and 2002

The first intervention of the NGO in Aalapot was the retrofitting of school buildings in 2001 to protect them during earthquakes. The school retrofitting process was utilized as an educational opportunity to disseminate knowledge of earthquake retrofitting for communities. Furthermore, according to Shiwaku [22]; local NGO experts offered classes for school teachers, students, and community members on “disaster risk in Nepal, earthquake risk in Nepal and schools, damage of past earthquakes, importance of structural measures and technology for earthquake safety.” Students A, B, C, and D also attended these classes.

Three main activities were put into practice in the year the SESC was established in 2001 and in 2002. First, an activity on community map making was held. SESC members walked around the community and identified risks related to floods, landslides, and earthquakes. Based on their observations, the SESC members developed an existing community risk map. They also shared their findings on the potential risks of natural disasters with the community. This elaborated map was also sent to the Risk Mapping Contest organized by the United Nations International Strategy for Disaster Reduction and won first prize in the children’s category (Fig. 2). Second, SESC members performed a street drama on earthquake risk reduction. The scenario was written by the local NGO and was based on stories of the 1934 earthquake in Nepal. Each student played a role that they practiced and performed in front of not only school students and community members, but also the public at events for Earthquake Safety Day held in the Kathmandu city center. Third, SESC activities were focused on communicating learned knowledge to community members and junior students. All of these DRR activities were held every Friday.

In 2002, by the NGO intervention, an exchange program between Bal

Fig. 2. Community risk map made by SESC [31].

Bikash and Maiko was initiated. One girl and one teacher from Maiko visited Bal Bikash and interacted with the SESC. This was the start of a long-lasting exchange program between the two schools, and a NGO specialist clearly stated that the visit by Maiko students was the motivation for the SESC to work on DRR. Furthermore, Bal Bikash's director was invited to Japan and he visited Maiko to observe their DRR education classes, such as the students' presentations related to the 1995 Great Hanshin-Awaji Earthquake. Upon return to Nepal, the director shared his experiences at Maiko with the students of Bal Bikash.

4.3.2. DRR education in 2003

SESC members continued to participate in DRR-related training and in the Earthquake Safety Day event and disseminated learned knowledge to the school and community. Meanwhile, Student A and the Bal Bikash director participated in a seminar called "Earthquake Safety in Schools - A Sharing of Experiences from Japan and Nepal," which was held on 31 July 2003 in Kathmandu. Governmental officers, school teachers, and students, attended the seminar, totaling approximately 40 people. The Bal Bikash director gave a speech on how their school worked to combat DRR issues, including SESC activities. The Maiko students also attended the seminar as a part of the exchange program and gave a presentation on DRR education activities and experiences related to the Great Hanshin-Awaji Earthquake.

Four students and two teachers from Maiko visited Bal Bikash and a 1-day cultural exchange program was held at the school. The SESC were responsible for organizing the exchange program. The Maiko students sang a Japanese song and Student B and other Nepalese students performed local dances. Some DRR education contents were included in the program. The SESC performed a street drama for the Japanese students (Fig. 3). Small group discussion on earthquake safety was also held in classrooms. The Maiko students gave a few earthquake safety tips and the Nepalese students asked questions such as, "How should we respond to shakes when driving?" and "What was the magnitude of the Miyagi earthquake?". A homestay program also started in 2003 and the Maiko students stayed 1 night at the Bal Bikash students' houses in Aalapot; in most cases, these were the houses of SESC members. This cultural exchange program along with the homestay continues annually. It is difficult to describe the DRR educational impact of the homestay; however, it is worth mentioning that students of both schools were dedicated to the study of DRR and the homestay was an opportunity for students to motivate each other to work on disaster-related issues.

Fig. 3. Street drama performed by SESC members.

4.3.3. DRR education in 2004

The SESC activities mentioned above continued at Bal Bikash in 2004. Meanwhile, the NGO organized a speech contest called "Earthquake Safety: Why and How?" for schools in Nepal as a part of the exchange program with Maiko High School students. It was held on August 24 in Kathmandu. Student A was the leader of the SESC and gave a speech on the SESC's activities in Bal Bikash. The speech also touched on experiences from the Great Hanshin-Awaji Earthquake and DRR education activities at Maiko High School. After the contest, Student A shared her personal knowledge gained during the speech contest with Bal Bikash students.

Sixteen students and two teachers from Maiko visited Bal Bikash this year to continue the exchange. Cultural exchange on DRR-related contents occurred even though these contents were not officially included in the program. However, the organization and planning of the cultural exchange program was a part of SESC activities and they were responsible for coordinating the program. One Maiko student stayed at Student B's home.

4.3.4. DRR education in 2005

The year 2005 marked the 10th anniversary of the Great Hanshin-Awaji Earthquake in Kobe. A conference entitled "Natural Disaster Youth Summit" was organized by Japanese stakeholders in Kobe, Japan. The first author was one of the organizers of the summit. Students and teachers from 11 countries attended, including Student B and a representative of Nepal from the NGO. The summit provided a series of events such as nature experiences, visiting the disaster museum in Kobe, lectures from experts, and discussion among participants. Student B was impressed by a shake table experiment in Japan, which demonstrates the importance of earthquake-resistant houses by shaking two small scale models of a seismic-resistant house and a non-seismic-resistant house at the same time. Motivated by this experience, she became involved in NGO activities in Nepal and demonstrated the shake table not only to the SESC, but also at other schools in Kathmandu.

In August, the Students' Summit on Earthquake Safety 2005 was held for 3 days by the NGO in Nepal. This summit was attended by six Nepalese schools with whom the NGO worked on DRR education, including Bal Bikash. Students B, C, and D were also participants, as were ten students and two teachers from Maiko. The contents of the summit can be divided into three parts. First, first aid techniques were explained by the Nepal Red Cross Society and an earthquake evacuation drill was implemented. Second, local NGO experts gave a presentation on earthquake vulnerability in Nepal and structural safety measures. Third, group discussions were held among students (Fig. 4). There were three topics of discussion: "What can school students do to help reduce earthquake risk?", "How can the schools help us to reduce earthquake risk?", and "What should be done to make your work easier and effective by institutions like NGOs, the District Education Office, and the Village Development Committee?". One group discussed the first topic and put forth ideas such as making signboards to raise awareness of earthquake risks, getting to know each other in the community, and putting on a public street drama. Another group discussed the second topic and came up with ideas such as providing first aid in the case of disasters, assisting with distribution of goods, and implementing DRR education. The third group raised ideas such as constructing shelters, creating an interest-free loan system for reconstruction, and making a picture book on DRR considering those who are illiterate.

After the summit, the ten students and two teachers from Maiko visited Bal Bikash for cultural exchange. Homestay was also carried out, with one student staying at Student D's home.

Records of DRR education could not be collected in 2006 and the visit by Maiko students was also canceled due to the civil unrest in Nepal. Student A graduated from Bal Bikash in 2005, and Students B, C, and D graduated in either 2006 or 2007.

The following sections describe the results of follow-up interviews conducted after the 2015 Gorkha earthquake to evaluate the former students' proactive attitude and to discuss how their proactive attitude was cultivated and developed throughout the DRR education process.

Fig. 4. Discussions among Nepalese and Japanese students on earthquake safety.

4.4. Proactive attitude after graduation

4.4.1. Student A

Since graduating in 2005, Student A has maintained a certain level of involvement in DRR-related activities. Her proactive attitude was confirmed because she kept in contact with the NGO and took part in NGO-organized activities. Because of her positive relationship with the NGO, she was able to access information on DRR-related events such as Earthquake Safety Day, which she attended. In addition, she has participated in awareness rallies, which involves marching in the streets with hundreds of youths while carrying signboards that highlight the importance of earthquake safety for the public. Thus, she maintained the interest in DRR-related activities after graduation and her proactive attitude led not only to participating in the events, but also to taking action to raise awareness of earthquake safety. The interview clarified that this proactive attitude originated from her experiences as the leader of the SESC. Recalling her time in the SESC, she stated in the interview that the SESC activities had fostered her capacity to take leadership, make decisions, and contribute to DRR activities. These activities also fostered in her an attitude of looking for solutions in the face of any kind of problem, which also proved useful for her job at a bank, where she currently works. For her, her experiences with SESC helped not only create a proactive attitude towards DRR activities, but also fostered self-efficacy in her daily life.

She was not living in Aalapot when the Gorkha earthquake occurred because she had moved to another village after getting married. She experienced strong shaking in her house and it was completely destroyed. In the interview, she stated that her economic situation did not allow her family to retrofit their house before the earthquake. After the earthquake, she taught her neighbors about appropriate responses in case of shaking as aftershocks continued, and oriented community members to adopt an earthquake-resistant structure when rebuilding their houses. She also rebuilt her house with an earthquake-resistant structure. Her actions after the earthquake further confirm her strong sense of responsibility and her proactive attitude to contribute to DRR activities.

4.4.2. Student B

Similar to Student A, Student B also maintained contact with the NGO, which facilitated her involvement in DRR-related activities. Approximately 1 year after Student B's graduation, the local NGO

organized a speech contest entitled "Earthquake Preparedness in My School" on August 21, 2007. More than 50 people including students, teachers, and governmental officers attended the contest. Student B attended this contest as an audience member. During the contest, 12 students who were involved in DRR education activities in Nepalese schools gave speeches about plate movement under the Himalayan mountains and the need for preparedness, including learning about how to respond in case of an earthquake and preparing emergency food and medicines. The first and second authors also gave speeches on DRR education activities at Maiko High School and shared knowledge of psychological care for those who suffer from natural disasters.

Our follow-up interviews identified that Student B had gained confidence from her experience with the SESC as well as her visit to Japan. As a result, after graduating, she became involved in organizing the Students' Summit on Earthquake Safety 2008, which the NGO organized together with the United Nations Children's Fund, the Japan International Cooperation Agency, and the United States Agency for International Development. More than 100 Nepalese and several Maiko High School students attended the summit (Fig. 5). At the summit, invited speakers from Pakistan shared their earthquake experiences. In addition, presentations were given on the earthquake mechanism, preparedness at home and school, and the importance of earthquake-resistant structures and non-structural safety such as safe distribution of furniture. In addition, first aid demonstrations and an earthquake evacuation drill were held. She assisted with the overall program management and logistics. She also attended the Earthquake Safety Day event afterwards. These facts also confirm that her experience with the SESC fostered in her a proactive attitude that led her to help organize the summit and attend the Earthquake Safety Day event.

When the Gorkha earthquake occurred, she was in the Dolakha district where the shaking was strong. She responded calmly and advised her neighbors not to panic during the shaking and instructed them to protect their head and body. At the time of the present study, she lives with her husband in Kathmandu and is aware that their house was built with the consideration of earthquake safety prior to the earthquake. It can be said that the DRR education at Bal Bikash led her to respond appropriately and give advice to those near her during the earthquake, which is also evidence of her proactive attitude.

4.4.3. Student C

His interest in DRR activities persisted even after graduating from Bal Bikash. On 24 August 2007, the first author and five Maiko High School graduates visited Bal Bikash with the aim of providing DRR education to students in the 8th to 10th grades at Bal Bikash. Even though Student C had already graduated by that time, he also attended the DRR education class, which he learned about from the Bal Bikash teachers. The contents covered were 1) Kobe earthquake experiences, 2) preparedness at home and school (fixing furniture, preparing an emergency bag, checking the structure of the house, etc.), 3) responses in the case of an earthquake, 4) a small shake table demonstration, and 5) trauma counseling (Fig. 6).

The class taught by the Maiko graduates became a positive opportunity for Student C to have contact with the Maiko High School graduates as well as the NGO. As a result, Student C became motivated to participate in organizing the Students' Summit on Earthquake Safety 2008, which was organized by the NGO and attended by the Maiko High School graduates. Student C also helped organize the Students' Summit on Earthquake Safety 2009.

Student C's proactive attitude to contribute to DRR activities grew as he participated in the DRR education class and the organization of the summits after graduation. Maintaining contact with NGO, he had voluntarily received training on earthquake-resistant construction techniques before the Gorkha earthquake in 2015. In 2013, Student C and Student D worked together to establish the Disaster Management Youth Committee of Aalapot. As of 2015, the committee consisted of 45 members. Since its establishment, members have advised the community to adopt earthquake-resistant structures. In addition, Based on this advice, four houses were newly constructed with earthquake-resistant structures by April 2015. The Gorkha earthquake destroyed approximately 600 of 670 houses in Aalapot and four people died (Fig. 7). However, those four houses did not sustain any damage. In addition, the houses of Student C and D had been also retrofitted before the earthquake and did not sustain any damage (Fig. 8). These facts confirm that their proactive attitude grew through their experience with the SESC, their involvement in organizing the summit, and their work to promote earthquake-resistant structures. As a result of their long-term involvement with DRR education activities, they helped not only their families survive the earthquake, but also contributed to mitigating damage in their community.

When the Gorkha earthquake occurred, Student C was working in his office near Kathmandu. He returned to Aalapot soon after the shaking, rescued several people from collapsed houses, and administered first aid. At the time of the present study, he was working at a construction company where he contributes to reconstruction after earthquakes. In the interview, he insisted on the need for continuous work in Aalapot for quick reconstruction and earthquake risk reduction in the future. His response and his contribution to reconstruction also confirms that he has maintained a proactive attitude since graduation.

4.4.4. Student D

Student D also maintained an interest in DRR-related activities. After

Fig. 5. Students' summit on earthquake safety 2008.

Fig. 6. DRR education at Bal Bikash (small shake table demonstration).

Fig. 7. Earthquake damages in Aalapot.

Fig. 8. The retrofitted houses in Aalapot sustained no damage. (Left: newly constructed house based on the advice, right: Student C's retrofitted house).

graduating from Bal Bikash in 2007, he helped organize the Students' Summit on Earthquake Safety 2009 together with Student C. In addition, four Maiko High School graduates visited Bal Bikash Secondary School in 2009 and provided DRR classes that involved Kobe earthquake experiences, preparedness for earthquakes, and trauma counseling. Student D also attended these classes and gained further knowledge. As mentioned above, he was the co-founder of the Disaster Management Youth Committee together with Student C. Similar to Student C, Student D was involved in SESC activities and learned about DRR. Then, after graduation, he focused on contributing to DRR by organizing the summit and establishing the youth committee. The proactive attitude exhibited by all four students suggests that the outcomes of DRR education at Bal Bikash Secondary School can be observed even after graduation, strongly indicating the importance of long-term intervention and evaluation.

When the earthquake struck, Student D was working in the center of Kathmandu. Soon after the earthquake, he returned to Aalapot and helped to rescue people from collapsed houses as well. In the interview, he expressed worry about a groundless rumor that another devastating earthquake was possible because some villagers believed that earthquakes occurred due to the movement of fish living beneath the earth. He stated that it was necessary to continue DRR education in Aalapot. Thus, he demonstrated his interest in proactively contributing to the community by providing future DRR education in Aalapot. The history of DRR education and the involvement of each student is shown in Fig. 9.

4.4.5. *Significance of long-term action-oriented evaluation in Bal Bikash*

Progress of DRR education and the involvement of four students in DRR activities from 2001 to 2015 are described based on the authors' participant observations and follow-up interviews. There are some significant findings, which can be distinguished from short-term knowledge-transfer evaluation and long-term retrospective evaluation. First, from the viewpoint of DRR activities, annual descriptions in the long term could visualize what Students A, B, C, and D experienced from involvement in SESC activities, how their proactive attitude was evoked, how they kept their high level of involvement in DRR-related activities after graduation, and how they responded during and after the Gorkha earthquake. Second, from the viewpoint of risk reduction, Students C and D were involved in SESC activities and continuous DRR activities after graduation, establishing the Disaster Management Youth Committee and contributing to the construction of four engineered houses, which substantially reduced damage from earthquakes in Aalapot. Third, from the viewpoint of educational development, long-term evaluation clarified that the experiences in the SESC enhanced the students' self-efficacy. Student A stated that the SESC helped to develop her leadership and decision-making skills. Student B stated that her SESC experiences increased her confidence. Furthermore, the proactive attitudes of Students C and D in organizing the Students' Summit on Earthquake Safety and establishing the Disaster Management Youth Committee also indicated their high level of self-efficacy. The importance of enhancing self-efficacy to facilitate preparedness actions was pointed out by Jassempour et al. [32] and Yu et al. [33]; but these studies were conducted over a short duration. The present study is significant because the comments were recorded and the actions were observed almost 10 years after the students graduated from Bal Bikash. As mentioned in the Introduction, previous studies such as Johnson et al. [11]; Chou et al. [13]; Amri et al. [12]; and Shaufa [14] pointed out the necessity of long-term evaluation with empirical education outcomes. We consider that the present study in Nepal addresses the shortcomings of the previous studies, as well as how DRR education in schools contributes to risk reduction and fosters a proactive attitude and self-efficacy. Thus, our study contributes to a new approach in which

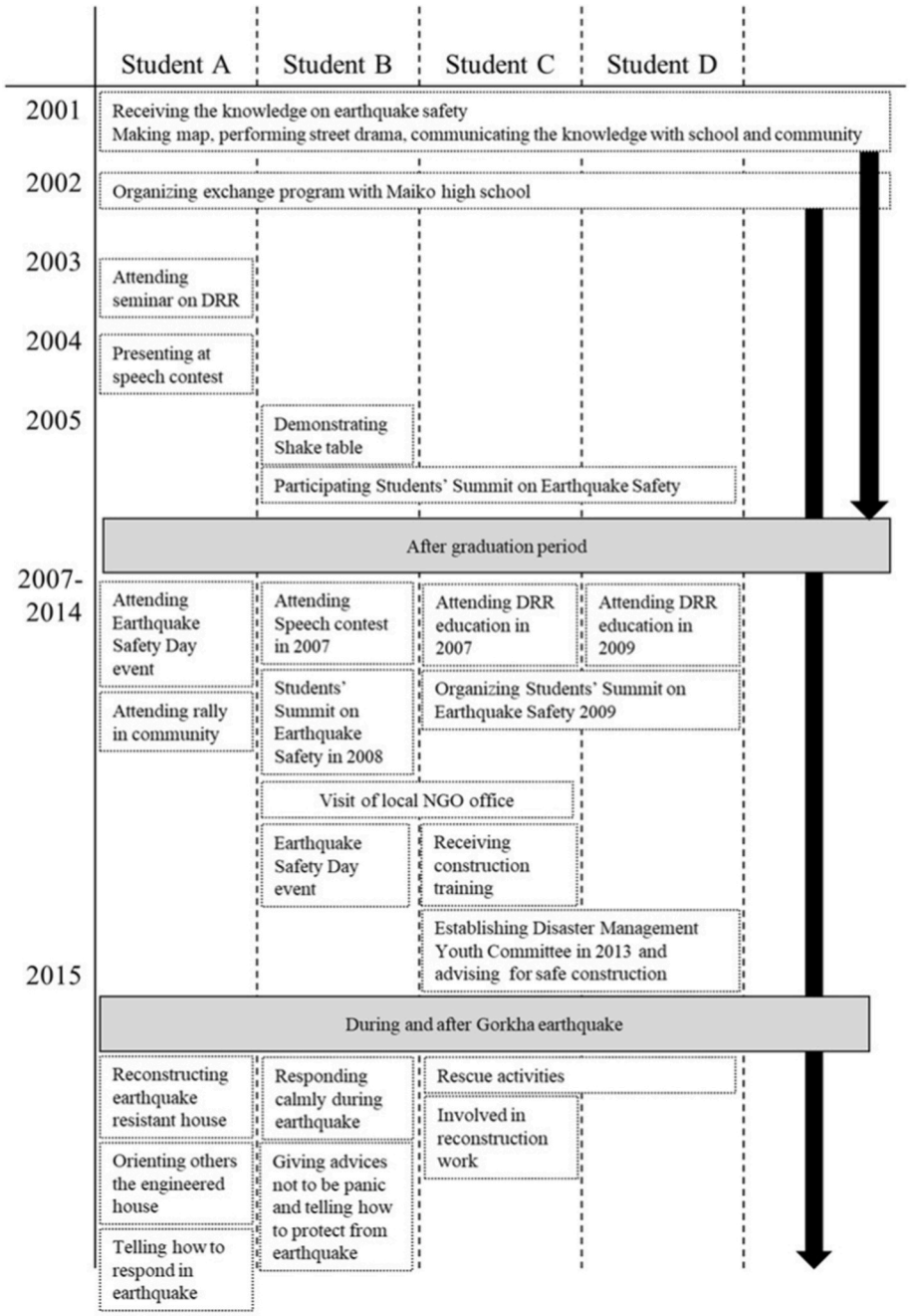

Fig. 9. Summary of DRR education activities and the involvement of four students in DRR activities.

evaluations are conducted over the long term free from the constraints of traditional the short-term knowledge-transfer paradigm.

The three findings described above are important outcomes of long-term action-oriented evaluation. Furthermore, the uniqueness of this case study is the progressive documentation of four students' involvement. It could visualize the accumulative process of DRR education and behavior change unlike a retrospective evaluation viewpoint. Analyzing the changes in attitude of Students A, B, C, and D from 2001 to 2015, three phases were observed to evolve. First, the educational phase occurred, which corresponded to the period since involvement in the SESC at Bal Bikash. The SESC repeatedly experienced the process of gaining knowledge, then sharing that knowledge to others. They made a risk map and shared their findings with other students and community members. They also practiced a street drama while learning about the situation surrounding the 1934 earthquake in Nepal and had the opportunity to perform the drama to different audiences to share their knowledge. The SESC's weekly activities also focused on teaching junior students and community members. Student A also attended, as a leader of the SESC, a conference and a speech contest for the purpose of learning and sharing. Student B has been to Japan and from that experience obtained knowledge from a shaking table demonstration, which she later shared with the SESC and other schools in Kathmandu. During this phase, even though the students had been actively learning DRR knowledge and sharing that knowledge, education event arrangements and coordination were basically performed by the NGO and Bal Bikah teachers. Hence, students basically followed the instructions of adults and options about whether education events could be realized basically depended on adults. Therefore, the students' activities rather depended on the local NGO and teachers, and all the activities were held within the educational context of teacher-student relationships.

The second phase may be considered participation corresponding to the period soon after the graduation of each student. Each of the four graduates maintained contact with the local NGO and started to participate in different DRR activities according to their own interest. During this phase, the decision to participate in the DRR activities was made available for each graduate; thus, the decision was made available outside of the educational context. Of course, the level of participation differed from graduate to graduate. Student A participated in the Earthquake Safety Day event and rally activities as a member of the public, while Students B, C, and D were more proactive in their participation in organizing students' summits.

The independent action phase followed the participation phase. Students C and D established the Disaster Management Youth Committee, and the decision to form the committee was self-initiated. They also proactively worked on earthquake risk reduction by suggesting earthquake-resistant construction. Students A and B also independently started making contributions by giving advice to neighbors, even though it was after the Gorkha earthquake.

Progressive description based on long-term action-oriented evaluation visualized the three phases that evolved in relation to attitude toward DRR activities. Three case studies, Maiko High School [25], Boy Scout [26], and Okitsu [15], previously introduced the long-term action-oriented evaluation and implied that a participatory educational approach, such as when students provide DRR-related education activities to the community, is an important medium (or step) helping students reach an independent action phase and develop a proactive attitude. The Maiko High School students taught school children in their community about DRR and volunteered in a disaster-affected area. These experiences led the students to continue their own independent DRR activities after graduation. Similar to the Boy Scout and Okitsu cases, learners had the opportunity to contribute to the community as part of their education and these experiences helped foster a proactive attitude.

Clearly, a limitation of this study is its small sample size and further studies with larger sample sizes are needed. Also required is the accumulation of data on long-term action-oriented evaluation to visualize more clearly the DRR education impact. When such a study is realized, and it suggests effective DRR education methodologies that are not hindered by either the inconsistency or the dissociation observed in short-term knowledge-transfer evaluation, then a proactive attitude may be fostered in learners.

5. Conclusion

This study introduced the strong tendency of short-term knowledge-transfer evaluation of DRR education and its problems with achieving the objective of promoting actions from two viewpoints; inconsistency and dissociation. To solve these problems and evaluate the actual actions taken by learners, three preceding studies were reviewed and three aspects were pointed out as bringing about a proactive attitude in students: the importance of continuous DRR education intervention, a DRR education program that provides learners with opportunities to contribute to the community, and a DRR education program that is oriented toward an active participatory learning method rather than toward knowledge transfer. In addition, from long-term action-oriented evaluation, DRR education was visualized to have a long-term impact on career development, with students involved in continuous preparedness actions and actively participating in DRR-related activities. These three case studies also suggested that the progressive nature of DRR education over the long term could visualize the accumulative process of DRR education practices and gradual changes in learners. Thus, the case of Bal Bikash from 2001 to 2015 was described in detail. Annual descriptions on the involvement of four students during their participation in the SESC and after graduation allowed for the drawing out of broad ideas on how their attitude toward involvement in DRR activities evolved from the educational phase, to the participation phase, then to the independent action phase. In addition, this case of Bal Bikash confirmed that DRR education could contribute to decreasing damage sustained in real disasters and foster self-efficacy in the long term. Together with the preceding three studies, the present study suggests the effectiveness of a participatory educational approach, resulting in actual contributions to the community rather than a mere transfer of knowledge. This approach should be incorporated in DRR education along with a long-term perspective. The results of this study suggest that this approach is the key to foster a proactive attitude in learners and lead learners to take actions toward DRR after graduation. This study recommends that DRR education researchers change their approach toward evaluation from evaluations of short-term knowledge-transfer to long-term action-oriented evaluations. Accumulation of data for long-term action-oriented evaluations led to the ability to explore an effective methodology for DRR education, which fostered a proactive attitude in learners.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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