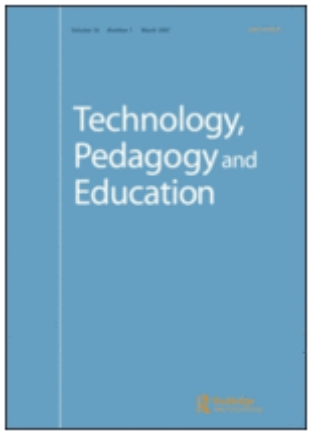

Facilitating Social Innovation through a School Emergency Preparedness Hackathon in Pakistan

Journal:	*Technology, Pedagogy and Education*
Manuscript ID	RTPE-2020-0286.R1
Manuscript Type:	Research Article
Keywords:	Innovation, LMIC, Hackathon, School Emergencies, Pakistan

Facilitating Social Innovation through a School Emergency Preparedness Hackathon in Pakistan

Hackathons can engage community members and youth in dissecting social problems and exploring solutions. The first-ever hackathon on school emergencies was organised in Karachi, Pakistan, where schools and community stakeholders worked together to deconstruct problems and develop solutions. The study aimed at investigating participants' motivation for and experiences of attending the hackathon. Qualitative and quantitative data were collected from the hackers (n=144), mentors (n=25), judges (n=6) and organisers (n=25). The pre-event expectations were collected through an open-ended questionnaire from hackers, and post-event evaluation data were gathered through an online questionnaire from hackers and mentors and SWOT analysis by the organisers. Findings indicate diversity amongst participants in terms of age, gender and experiences. The hackers' motivations were both intrinsic and extrinsic. These included learning about hackathons, creating an innovative solution to address school emergencies, socialisation, collaboration, and future career prospects. The challenges were related to insufficient time, absence of investors, inconsistent mentoring, public schools' inadequate participation, and imbalanced gender participation. The hackathon provided a unique opportunity for multidisciplinary collaborative problem-solving and accessing experts for creativity and innovation. Future research needs to focus on increasing participation and facilitating social innovation through civic hackathons at the school level.

Keywords: Hackathon, low-middle income country, school emergencies, emergency preparedness, Pakistan, innovation

Introduction

Emerging out of technology companies in the early 2000s as a way of designing new codes and software in a low-risk setting, hackathons have now become a well-known phenomenon in wide-ranging industries such as healthcare to address complex problems (Briscoe & Mulligan, 2014; Leckart, 2012; Johnson & Robinson, 2014). Hackathons are collaborative events where people from diverse backgrounds – in terms of field, skills and age – work together on problems or

challenges to propose innovative and practical solutions over a specific period (Granados & Pareja-Eastaway, 2019). They have the potential to develop ideas and solutions to problems by making the covert overt by bringing together participants from various fields of work in the same room with a common goal. The diversity in the cohort of participants (or 'hackers') allows them to view the problems from different perspectives. The combination of various fields and views allows the participants to identify long-standing problems that the stakeholders have ignored or missed (Briscoe & Mulligan, 2014).

A variety of different types of hackathons currently exist. Bazen (2018) describes a 'creathon' as a type of hackathon where the teams focus on creating solutions instead of software development. In this type of hackathon, intellectual property remains with the hackers giving them greater incentive to develop the solutions. Hackathons organised around social issues (also known as civic hackathons) are also a growing phenomenon globally where citizens are invited to join the event targeted on specific civic issues to own the problem and propose solutions. Through these events, governments also aim to enhance civic engagement by enabling people to be a part of a participatory event for solving the city's problems based on government data (Johnson & Robinson, 2014). While much has been written about the success of civic hackathons, literature has also questioned the utility or quality of the solutions produced during these events (Carr & Lassiter, 2017 cited in Gama 2017; Johnson & Robinson, 2014). Since hackers develop solutions based on their prior experiences that may not be relevant to all the citizens, the solutions are easily abandoned (Townsend, 2013 cited in Gama, 2017). Hence, finding out the reasons for participation in civic hackathons could be an essential consideration when determining the quality and sustainability of solutions emerging from the hackathons.

In Low and Middle-income Countries (LMIC) such as India, Kenya and Pakistan, hackathons have been organised on educational and social issues. Specifically, in Pakistan, the first civic hackathon was held in 2003, and since then, several hackathons on civic and social issues have been organised aimed at solving the entire city's problems or addressing issues related to the Sustainable Development Goals (Code for Pakistan, n.d.; The World Bank, 2014). Though there is a growing number of hackathons in LMICs, evidence on what motivates the hackers to participate in hackathons voluntarily, how participants experience these events, what are the educational outcomes of social hackathons, and the role hackathons could play in developing innovations for civic and educational problems remains scant in the literature. Therefore, this paper aims to provide insights into and enhance our understanding of facilitating social innovation by analysing participants' motivations, and experiences of a school emergency hackathon (Hack_SPE) held at the Institute for Educational Development, Aga Khan University (AKU-IED) in Karachi, Pakistan. Specifically, the paper addresses the following questions:

(1) Who were the participants of Hack_SPE, and what motivated them to participate in the event?

(2) What were the experiences of the participants before and during the event?

The results shared in this paper will benefit those in LMICs who wish to incorporate hackathons as a tool for social innovation and restructuring the teaching-learning processes at the school level. The results will also be interesting for researchers interested in school-university partnerships and incorporating innovation and digital learning to improve the quality of teaching and learning in LMICs.

The idea of school emergency Hackathon

Given Pakistan's history of dealing with natural and human-made disasters over the past several decades, emergency preparedness of schools is an important area of concern for schools and other academic institutions. Such emergencies and disasters have continued to cripple the country both economically and socially. The toll of the war on terror and the various natural disasters on the education system is unfathomable. According to Kirsch, et al. (2012), the 2010 Pakistan floods affected 14-20 million people and killed over 1,700. The floods lasted almost six months in some areas and caused $9.7 billion in damage in 46 of the country's 135 districts (The World Bank, 2010). According to one estimate, approximately 9,700 government schools were damaged or destroyed during the floods (The Express Tribune, 2010). In 2018, during a panel discussion on *School Preparedness for Emergencies* at the National Health Sciences Research Symposium (NHSRS), panellists identified the need to develop safe schools. They highlighted schools' vital role in raising awareness among students, teachers, and parents for the safety of children during emergencies. Although various uncoordinated efforts have been undertaken by the Non-government Organisations (NGOs) and the government, there is still a significant gap in schools' preparedness for emergencies that is timely, effective, and sustainable. This gap presented an opportunity for the authors to bring together relevant stakeholders to identify problems and find innovative solutions for school preparedness for disasters and emergencies. Subsequently, Aga Khan University Institute for Educational Development (AKU-IED) and Critical Creative Innovative Thinking (CCIT) forum at a private university in Karachi, Pakistan, organised the hackathon on School Preparedness for Emergencies (Hack_SPE).

The focus of AKU-IED's work is on improving education in the developing world through research, education, and policy advocacy. The institute works closely with schools in

Pakistan to bring about educational change. Constructivist approaches such as critical thinking, problem-solving, collaborative and cooperative learning, and inquiry-based approaches are integral parts of AKU-IED's academic and research programmes. The CCIT forum is an innovation and incubation hub to promote a better future through the use of 21st-century skills, ranging from critical, creative, innovative, and entrepreneurial thinking to design principles steeped in empathy. Hackathons are the most significant events conducted by the CCIT forum to prepare students of today to become leaders of tomorrow. The CCIT had organised the first hackathon in the fall of 2016. Since then, four more hackathons have been organised over the past four years to address the healthcare needs of local populations and have shown the capacity to accelerate solutions (Ahmed & Mian 2019; Farooqi, Subhani & Mian, 2017; Madhani, Farooqi & Mian, 2017; Berger, 2017). The first four hackathons were based on emergency medicine, child health, medical education, and global surgery, respectively. The typical format of the hackathon requires participants to work together over two to three days to identify problems, form teams, dissect problems, develop solutions, and present a final idea/product/process to the jury. The previous hackathons have shown positive outcomes in cross-disciplinary problem identification and solution development in healthcare.

Hack_SPE was a three-day event from January 24th to 26th, 2020, at the AKU-IED campus in Karachi, Pakistan. The event was advertised in November 2019 through social media and the AKU-IED's partner schools. An open call for participation, inviting all interested in the theme to participate in the Hack_SPE, was made. Registration was closed a few days before the event. Individuals from various institutes and organisations signed up, paid the fee (PKR 500 for students and PKR 1000 for all others) and attended the event. Day one began with registration, followed by the event proceedings such as the introduction of the mentors, problem pitching by

individual participants, team formation and working on the identified problems as a part of the hacking process. On day two, teams were finalised, and hacking continued till evening. By the end of the second day, the teams had developed solutions for their selected problems and presented solutions to a panel of mentors to receive feedback. A motivational talk by an experienced female surgeon was also organised on the second day. She had worked extensively in Pakistan's remote mountainous regions during earthquake emergencies. On day three, teams presented their solutions in front of a panel of judges. There were breaks for fun activities and meals to keep the energy levels and motivation high among hackers.

Materials and Methods

The study used mixed methods research design to understand the hackathon participants' experiences and motivations.

Sampling

The participants of the study were recruited from the entire attendance list of Hack_SPE, which included hackers (n=144), organizers and volunteers (n=25), mentors (n=25) and judges (n=6).

Data collection

The data were collected through various means before, during and after the event. The quantitative data were gathered through the initial registration form, where the participants were required to provide information such as gender, age, contact details, qualification, professions, organisational affiliation. They also had to identify in 50-words, or less, a problem they or someone they knew had experienced or observed regarding school emergencies. Post-event, the participants and mentors were required to complete the evaluation form, having 13 items on a

five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). These were analysed to understand the experience during the hackathon.

The qualitative data were collected from the hackers on the first day of the event through a pre-event questionnaire where they were asked to provide reasons for participating in and expectations from the hackathon. One week after the event, data were gathered from the organising team in the SWOT analysis session to analyse the experience of organising the event. The session was moderated by a facilitator and recorded with the permission of the members. In addition, the notes of the planning meetings from before the event were documented and analysed to understand the organising team's experiences of planning the event.

Data analysis

The quantitative data were entered and analysed using the SPSS version 22. The qualitative data were analysed using content analysis techniques by three authors (AN, SA, SY) independently. The emerging themes were discussed to reach a consensus on the themes included in the results section.

Ethical clearance

Ethical approval was obtained from the University's Ethical Review Committee (ERC # 014-ERC-SSHA-20) prior to commencement of the study. Consent for participation in the hackathon and subsequent incubation programme was obtained. For all children under 18, the project information sheet and the consent forms were sent to the parents/guardians via email and children were given an assent form.

Results

Participant demographics

A total of 327 participants registered for Hack_SPE, of which 179 (55%) were female and 148 (45%) male, as shown in table 1. Out of the total registrants, only 144 (44%) participants paid the fee and attended all three days of the event. Although this represented attrition of 183 (56%) participants, the number of actual hackers at the event was sufficient given the limitation of the physical space for the event. Also, in the actual event, female participation (n=68, 47%) was relatively lower than male (n=76, 53%) participation. Further, most participants who attended all three days were from private institutions (n=131, 91%). There was much diversity in the age and professions among the participants. For instance, the youngest hacker was ten years old, and the oldest was sixty years old. Most of the participants were thirty years or below (n=90, 66%). Hackers included school security guards, teachers, school and university students, science-laboratory in-charge, school managers, university professors, and hospital emergency department personnel.

INSERT TABLE 1

Twenty-five experts voluntarily invested time and expertise to mentor the teams of hackers during the event. The mentors' role was to help the teams dissect problems, assess their solutions, and prepare for the final presentations. The mentors had expertise in teacher education, IT, healthcare, safety and security, and school management. Approximately 25 people were involved in the planning of the event. These included student-volunteers, teacher-educators, emergency medicine doctors, safety and security, IT and facilities management. Altogether six judges evaluated the teams' presentations on predetermined criteria such as impact, relevance, feasibility, innovation, and cost. Each judge independently evaluated the presented solutions, and

scores for each team were accumulated to assign positions to the top teams. The judges had expertise in school education, entrepreneurship, and emergency preparedness.

Hackers' motivation for participating in the event

The hackers were asked to share reasons for attending the event and their expectations in the registration form. The novelty of the event seemed to have drawn many hackers to attend the event. The participants mentioned that it was the first time a hackathon was organised for schools; therefore, they were motivated to attend it and learn about hackathons. Given below are selected quotes from the hackers to show the reasons for participating in the event:

- 'My expectations are to learn a lot of new innovative things' (Hacker # 10, Male, Student)
- 'I expect that this event will create a greater degree of sensitisation for me about the school emergencies that occur at the time [of] natural or human-made disasters and effective preparedness to deal with those emergencies' (Hacker # 33, Male, Teacher)
- 'To learn about how to think of problems from an innovative perspective and come up with realistic solutions.' (Hacker # 60, Female, Healthcare provider)
- 'This event will provide me a better stage in future career or build up personality' (Hacker # 22, Female, Student)
- 'To meet people from different backgrounds and learn about their ideas and thoughts.' (Hacker #47, Female, Student)
- 'I want to learn something new to protect my school from any emergency.' (Hacker # 84, Male, School security guard)
- 'To develop leadership qualities' (Hacker #40, Male, School assistant)

- 'I expect hackathon to teach me co-operation and collaboration and train me how to stay present minded and respond quickly.' (Hacker #4, Female, Student)
- 'Personally, I will be able to enhance my speaking skills.' (Hacker #79, Male, Student)
- 'I will expect that it would be a great fun time.' (Hacker #81, Female, Student)
- 'encouraged by the teacher' (Hacker #53) to attend the event

Overall, the motivating reasons were both intrinsic (e.g., learning about hackathons, innovation in education and school emergencies and personal skills development) and extrinsic (e.g., socialisation with people from different disciplines, future career prospects, meeting the requirements set by the school management).

Post-event Satisfaction by the Hackers

Altogether 40% (n=52) of the hackers responded to the post-event evaluation survey. Out of these respondents, 32 (61%) were students, whereas 20 (39%) were professionals. In terms of gender, 24 (46%) were female, and 28 (54%) were male hackers. The majority of the respondents (n=45, 86%) revealed that Hack_SPE was the first hackathon they had attended. In table 2, the overall mean score (M=3.8, S.D=0.84) suggests that the majority of the participants were satisfied with the event. The two most highly rated items were: 'I felt overall organization of the activity was commendable', and 'I felt mentors/judges played a necessary part in Hackathon'. The two least favourable items were: 'I felt the given time was adequate to complete the hackathon' and 'I felt that solutions proposed by teams were realistically implementable'.

INSERT TABLE 2

Only 5 out of 25 mentors completed the evaluation form. The overall mean score (M=4, S.D=0.36) suggests that the five mentors who completed the evaluation form were satisfied with the hackathon (Table 3).

INSERT TABLE 3

Incubation process

The Hack_SPE teams were offered an opportunity to incubate their ideas with the CCITs Incubation Programme. A follow-up with the hackers for incubation to achieve actual long-term outcomes was also reported as a strength in the evaluation data. However, due to the COVID-19 pandemic, we had to delay the initiation of the incubation programme to May 2020. Similarly, the structure of the incubation process had to be changed from a face-to-face on-campus programme to a virtual incubation programme. At the time of writing this paper, a total of 25 participants (female = 18 and male = 7) had worked in the five different teams on their initially developed ideas during Hack_SPE. One of the teams made changes in the initial ideas while linking the COVID-19 pandemic to schools. For instance, this team has linked healthcare with school emergencies. The results of the incubation have been reported in Ahmed & Mohsin (2021).

Experiences of the mentors and the planning team

The analysis of the qualitative data from the evaluation forms by the mentors and the SWOT analysis session has highlighted the following themes:

Nature of the problems being hacked

The problems of school emergencies identified by the participants in the registration form ranged

from human-made disasters such as terrorism, kidnapping, road accidents to natural disasters, for example, heavy rains, flooding, earthquakes. The issues of mental health were reported as outcomes of emergencies. In the hackathon, the problems pitched and hacked were related to 1) mental health, 2) natural disasters, 3) physical injuries, and 4) human-made disasters. These were emergencies commonly faced by schools in Pakistan.

Mentoring process

The presence of experienced professionals as mentors was mentioned as the strength of the event. However, the organising team members noted that not all mentors provided an equal amount of mentoring to the teams. Some became involved in the hacking process, thus blurring the boundaries between hackers and mentors, while others paid cursory attention to the team's hacking process. One mentor suggested that in future hackathons:

> '[a] mentor [could] be assigned to a group to act as the facilitator for that group. This would mean guiding them on who to reach out to because, at times, the teams did not understand the expertise of the mentors. As a result, it was actually other mentors who would seek each other out after listening to the team and determining who the best person could be that they speak to.' (Mentor #3)

Problem solving and the hacking process

Recognising the types of learning that took place during the hackathon, mentors and planners mentioned that the hackathon could be a venue for students to learn how to solve a problem, defend their ideas and be creative. Hackathons could enable intergenerational learning and provide access to experts that many schools in Pakistan cannot offer, as mentioned by one programme planner:

> 'As I was walking around, I saw a group where a school student was giving logical reasons for why his solution was better as compared to the solution presented by an older member of the group. This child argued that he had researched the prices of raw materials on Alibaba, and if the materials were ordered in bulk, it would bring down the cost of the solution. I was struck by this conversation. In schools, how often do we give our students a chance to question the teacher or defend their ideas with research?' (SWOT Analysis)

Both mentors and organisers mentioned that the hacking process could be improved by giving more time or providing additional support before the event to prepare the hackers to 'deconstruct problems in context' (Mentor #3).

Time

Both mentors and organisers noted that time was not sufficient for the teams to hack problems adequately. Much time was spent on team formation based on the problem pitches and rapport building, leaving little time for the hacking process. A mentor noted: 'Ideally, the mentor could also assist with group dynamics, particularly on day 1.' (Mentor #3)

Marketing of the event

The concept of a hackathon was new for schools in Pakistan; therefore, it took time to convey the message that 'this hackathon is relevant and productive' (SWOT analysis) to all those affiliated with schools. Consultation sessions were conducted with the school principals and staff responsible for emergency preparedness to raise awareness about the hackathons. A social media campaign was organised alongside the planning teams' visits to schools and pre-event seminars on emergencies in Karachi. One organiser mentioned: 'We learned that relying on a single source of marketing would not be an effective decision…. Personal visits, word of mouth and interactions (with stakeholders) attracted sufficient participants, which is evident from the

number of registered participants (i.e., n=327)' (SWOT analysis).

Space constraints

The campus where the event was organised had the technology and logistical facilities to host a community event. While the main hall could accommodate all the hackers, there was not enough space for everyone to work comfortably. Therefore, teams had to be divided into different rooms across two buildings. All the rooms were virtually connected using Zoom, and everyone could see the activities taking place in the main hall. Though this virtual connectivity helped keep participants motivated, it also created challenges. For instance, in smaller rooms, teams had turned off the volume while hacking the problems and could not hear the announcements leading to difficulties for the teams and mentors to communicate in real-time. Mentors and organisers also mentioned that being present for all the teams spread across two buildings and various floors was a challenge.

Absence of investors

Another challenge reported by the planning team was the absence of investors and sponsors in the event. Though an attempt was made to invite potential investors, it was not successful.

Discussion

Hack_SPE was the first hackathon on school preparedness for emergencies to be held in Pakistan. It drew participants from a diverse range of backgrounds, all associated with schools and/or emergencies. During the three-day event, hackers worked in teams to de-construct problems and identify solutions. Mentors guided the hackers through the hacking process. Some of the strengths of the event included multi-disciplinary collaboration amongst hackers, the

presence of mentors from diverse backgrounds, high motivation level and interest of the hackers, and the relevance of the theme of the hackathon to the educational needs in Pakistan. The challenges were related to low female participation, insufficient time for the hacking process, absence of investors, inconsistent mentoring, absence of students and teachers from the public schools, and physical space constraints.

In terms of motivations for participating in the event, the findings echo previous research suggesting that motivations were intrinsic and extrinsic and ranged from personal to professional (Ferreira & Farias, 2018; Gama, 2017). The hackers were primarily driven by intrinsic motivations, which involved learning about hackathons or school emergencies, meetings others and the desire to make an impact in their schools or community. These findings are consistent with Briscoe and Mulligan (2014), where learning, networking, and social change were the top three reasons for attending a hackathon. While studies have identified prize money as a motivating factor in civic innovation (Almirall & Majchrzak, 2014), none of the Hack_SPE participants mentioned it as a reason for participating in the event. Moreover, the problems that were hacked were related to the emergencies commonly encountered in schools. Hence, it appears that most of the teams were intrinsically motivated to develop solutions to problems based on empathy. Not only is empathy one of the prerequisites for creativity and innovation (Kelley & Littman 2001; Organize Agile, n.d.), it can lead to greater ownership of the solution and the development of more sustainable outcomes. High satisfaction during the post-event evaluation also confirms that the participants' expectations were met.

Though both men and women participated in the Hack_SPE, we noted fewer female hackers, irrespective of this ratio changing in favour of women innovators for the incubation phase. This is a surprising finding compared to the previous hackathons at the university on

topics related to healthcare, where most of the participants were female (Butt, et al., 2020). However, this does not seem unusual in the global context, as others have also reported the underrepresentation of women in hackathons (Briscoe & Mulligan, 2014). Women's participation in Hack_SPE is perhaps a reflection of women's participation in education and employment in Pakistan in general. According to 2018 statistics, of those attending schools, 44% are girls (Central Asia Institute, 2018), and according to GSMA (2021) report on "Addressing the Mobile Gender Gap in Pakistan", women are "49 per cent less likely to use mobile internet". The name hackathon could create an impression that it is a competition meant for computer geeks who are often young men. Young girls who typically require the family's permission to participate in out-of-school activities could find it challenging to get permission to participate in such events. The previous hackathons at AKU where we saw greater participation by women could be because the hackers were mostly university students or employees, and the number of women in medicine and nursing is comparatively higher. Also, we noted fewer hackers from the public institutions, which meant that the problems and solutions were more relevant for the private schools. The absence of teachers and students from the public schools could be a reflection of the reality in Pakistani society where children going to public schools do not always have access to social media technology to learn about hackathons and other events. The staff of the public schools in Pakistan need permission from the local education authorities to attend an event outside the school, which could be a long process. It is also a reality that most public school students belong to the lower-socioeconomic strata of the society (Siddiqui, 2017). Many are expected to help at home or assist older siblings or parents in economic activities. Therefore, it may not always be possible for them to attend events outside the school. With low female participation and limited attendance of participants from the public schools, the SPE_Hack

seems to have been a microcosm of the broader Pakistani society where both gender and social disparities limit access to good quality education. Future hackathons should focus on widely disseminating information about hackathons in the schools and communities, raising awareness about the role of hackathons in students' learning and providing support to enable girls' participation in these events.

Active participation was observed by those under 30 years of age. This finding is consistent with other hackathons (Olson, et al., 2017), where the youth seem to be keener about using innovative approaches to develop technologically sound and practical solutions to existing problems. Hackathons also favour the youth in terms of the format, which is a weekend-activity that is more suitable for younger people with limited responsibilities. With Pakistan's majority younger population, hackathons could be a valuable tool to engage youth in creative activities to improve social and economic conditions. Moreover, a diverse representation of educational and non-educational professionals, with half the total participants as school and university students, meant that the event provided a unique opportunity for interdisciplinary learning with professionals. In overcrowded schools, encouraging students to discuss and express their opinions and solve problems in groups is challenging. In the hackathon, participants also learnt essential life skills such as collaboration, defending their argument and questioning in an acceptable way, project development and management, and understanding individual differences (Nandi & Mandernach, 2016).

The issue of teams receiving inconsistent mentoring was highlighted by the mentors and the organising team, which could be the result of a lack of preparation of the mentors for their role in the hackathon. Mentoring can mean different things in different contexts and could be based on varying expectations between mentees and mentors regarding the role of mentors. Also,

the presence of new and inexperienced mentors could lead to inconsistent mentoring. Assuming that all subject matter experts know how to scaffold the learning of an intergenerational, multi-disciplinary and multi-context team of hackers could be problematic as not everyone may have the skills to balance direction vs mentoring. Similarly, it should not be assumed that all hackers would know how to benefit from the mentors and the mentoring process. As reported by others, appropriate mentoring could lead to successful outcomes in hackathons (Ruiz-Garcia & Subirats, Freire, 2016), preparing mentors for their specific role before the event and preparing hackers for what to expect could help address the issues around mentoring.

Despite inconsistent mentoring, the hackathon provided access to experts (mentors), which is often not possible in schools in Pakistan, where there is a severe shortage of qualified teachers in many schools. Over-crowded classrooms also constrain a teacher's ability to provide individual attention to students in classrooms. Being able to work in small groups in the presence of mentors, the Hack_SPE demonstrated examples of collaborative learning across age and professional groups as a cornerstone for problem-solving and innovation. All members of the hacking teams had a role carved out for them, and the team's success depended on each member contributing to the hacking process. There was individual and group accountability where team members were seen defending their ideas as represented through the observation shared by the event organisers, where a student was seen as defending his idea in front of a group of older team members. Learning how to define a problem, argue one's position with evidence, socialise with people from various backgrounds and present in front of a panel of judges are some of the implicit outcomes of this community learning event. Further research could focus on understanding group processing, how meaning is negotiated within the multi-generational hacking teams, and whose ideas are valued for the final solution. In the words of Johnson and

Robinson (2014), there is a 'need for targeted Hackathon research that tracks these events as they occur, tracing both immediate and longer-term impacts' (p.356). Since we are still in the first stage of incubation, our future research will be focused on finding the long term impacts of the solutions developed by different teams. Greshwin (1994) has reminded us that motivation alone does not lead to change. For real change to be implemented in education, change is needed at the levels of attitudes, practice and the practitioners' knowledge-base (Fullen, 1991). The hackathon has assisted in the first step of innovation diffusion (Rogers, 1983) by introducing hackathon as an innovative avenue for learning. Future research should explore how hackathons could be adopted widely by the schools for engaging students in innovation beyond classroom-based teaching.

Conclusion

The study has reminded us that hackathons are likely to mirror the gender and social disparities in the wider society; therefore, hackathon planners should overtly plan for the participation of girls and others from marginalised segments of the society. Moreover, hackathons might not create viable solutions for the social and educational problems; rather, these events could be mechanisms for education and professional development by engaging the youth, teachers and community members on problem-solving, critical thinking and developing solutions. An explicit focus on mentoring, developing problem-solving skills and group processing of the hacking teams would be necessary. Finally, if our children are to learn the skills and attitudes for the rapidly changing world, hackathons could be organised both in schools and in communities, with members of the schools and community as part of the organising teams, for greater ownership of the problem-solving process, and facilitation of innovation and implementation of change.

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Table 1: Demographic details of the hackers

	Registered n (%)	Attended n (%)
Gender		
Male	148 (45%)	76 (53%)
Female	179 (55%)	68 (47%)
Age Range		
Below 19 years	62 (19%)	46 (32%)
20 - 30 years	170 (52%)	50 (35%)
31 - 40 years	55 (17%)	28 (19%)
41 - 50 years	30 (9%)	16 (11%)
51 years or above	10 (3%)	4 (3%)
Profession		
Staff	4 (1%)	1 (0%)
Civil / Government Official	1 (0%)	-
Lawyer	1 (0%)	1 (1%)
Engineer	2 (1%)	1 (1%)
Entrepreneur	2 (1%)	-
Healthcare Professional	40 (12%)	9 (6%)
Housewife	1 (0%)	-
IT Professional	2 (1%)	1 (1%)
University Lecturer / Teacher educator / Researcher	12 (4%)	2 (1%)
ECE Practitioner / Counsellor	2 (1%)	1 (1%)
Safety and Security Personnel	11 (3%)	9 (6%)
School Teacher / School Administrator	76 (23%)	45 (31%)
Social / Community Worker	3 (1%)	1 (1%)
Student	169 (52%)	72 (50%)
College Teacher	1 (0%)	1 (1%)
Sector		
Public	52 (16%)	13 (9%)
Private	275 (84%)	131 (91%)

Table 2: Hackers evaluation of the event

S.N	Items	N	Mean	S.D.
1	I felt inspired after attending the Hackathon	52	3.84	1.21
2	I felt that problems proposed by teams were relevant and important	52	3.9	1.17
3	I felt that solutions proposed by teams were realistically implementable	52	3.32	0.98
4	I felt presentations were at the level of my understanding	52	3.92	1.04
5	I felt teams were a healthy mix of people from different fields	52	3.94	1.17
6	I felt Hackathon helped increase knowledge of school emergency preparedness problems/ solutions	52	3.86	1.18
7	I felt mentors / judges played a necessary part in Hackathon	52	4.03	1.17
8	I plan to continue developing my team's proposed solution further	52	3.98	1.3
9	I felt different activities of the event started and finished on time	52	3.63	1.18
10	I felt the given time was adequate to complete the Hackathon	52	3.25	1.32
11	I felt the schedule was relaxed, non-stressful and fun	52	3.57	1.36
12	I felt that mentoring / judging was fair	52	3.84	1.24
13	I felt overall organization of the activity was commendable	52	4.05	1.1
	Overall mean	52	3.78	0.84

Table 3: Mentors' evaluation of the event

S.N	Items	N	Mean	SD
1.	I felt inspired after attending the Hackathon	5	4.2	0.36
2.	I felt that problems proposed by teams were relevant and important	5	4.2	0.68
3.	I felt that solutions proposed by teams were realistically implementable	5	3.4	0.73
4.	I felt presentations were at the level of my understanding	5	4	0.57
5.	I felt teams were a healthy mix of people from different fields	5	3.6	0.93
6.	I felt Hackathon helped increase knowledge of school emergency preparedness problems/ solutions	5	4.2	0.36
7.	I felt mentors / judges played a necessary part in Hackathon	5	4	0.57
8.	I plan to mentor / judge at future Hackathons	5	4.4	0.44
9.	I felt different activities of the event started and finished on time	5	3.2	1.06
10.	I felt the given time was adequate to complete the Hackathon	5	4	0
11.	I felt the schedule was relaxed, non-stressful and fun	5	3.8	0.89
12.	I felt that mentoring / judging was fair	5	4	0
13.	I felt overall organization of the activity was commendable	5	4.2	0.36
	Overall mean	5	3.93	0.36