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AI-empowered Train-the-Trainer (*AITT*) Program: Building Resilience and Professional Competencies

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***Abstract*—Urban disasters impose post-traumatic stress disorder (PTSD)-like burdens on youth. However, IT-supported resilience interventions remain scarce. Limited scalable AI-empowered solutions combining emotional support, engagement theory, and service-learning for higher education post-trauma recovery. We recruit 48 university students (SUs) to join an AI-empowered train-the-trainer (*AITT*) program. This program includes multi-stage train-the-trainer activities, such as positive seminars and AI-empowered social robot workshops. The trainers instruct primary students who are affected by the Tai Po fire. We employ pre- and/or post-questionnaires of self-determination theory (SDT), Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5), and teaching and learning. Engagement and motivation demonstrate statistically significant improvement. Teaching efficacy and learning experience exhibit moderate to high effectiveness. The SUs report that they achieve interpersonal success. To conclude, the *AITT* program builds resilience and competencies. This is scalable for IT-based higher education disaster response.**

***Index Terms*—Motivation, Engagement, Social Robot, Resilience, PTSD, DSM-5, Emotional support, Self-determination Theory**

I. Introduction

The fire in Wang Fuk Court imposes psychological burdens on nearby youth, such as undergraduates, college, primary school students, and pre-schoolers. They manifest as emotional distress, diminished learning motivation, concentration deficits, and post-traumatic stress disorder (PTSD) symptoms (e.g., intrusive memories and avoidance) [1]–[3].

a) Self-determination Theory and Engagement: Self-determination theory (SDT) posits that satisfying three basic psychological needs: autonomy (volitional action), competence (mastery), and relatedness (meaningful connections) [4]. SDT boosts motivation and engagement in educational settings [5]. Robot-empowered learning supports these by providing non-judgmental and personalised interactions to enhance emotional engagement and resilience [6]–[9]. Behavioural engagement manifests as effort and persistence [10]. Also, emotional engagement is expressed as interest and enjoyment [11]. Furthermore, cognitive engagement can be viewed as strategic processing [12].

b) Post-Traumatic Stress and DSM-5: The severity of PTSD symptoms is measured by the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5) checklist [13]. PTSD demonstrates trauma exposure symptoms in four clusters: (1) intrusion (e.g., recurrent distressing memories, nightmares, and flashbacks) [14]; (2) avoidance (e.g., reminders) [15]; (3) negative alterations in cognitions/mood (e.g., guilt, detachment, and anhedonia) [16]; and (4) arousal (e.g., irritability, hyper-vigilance, and concentration issues) [17].

c) Self-Efficacy and Service-Learning: Self-efficacy refers to beliefs in managing disruptions, motivating students, and deploying strategies [18]. Through service-learning, students can be trained to amplify professional competencies [19], teaching self-efficacy [20], learning experiences (e.g., knowledge transfer) [21], growth (e.g., reflection and leadership) [22], social commitment (e.g., empathy for vulnerable groups) [23], and self-awareness [24] through authentic instructional roles. Moreover, digital tools (e.g., social robots) can enable scalable training [25].

Disasters, such as the fire in Wang Fuk Court, can potentially disrupt resilience. However, targeted interventions remain scarce, particularly those leveraging information technology for scalable support in higher education. To bridge this gap, we developed an AI-empowered train-the-trainer (*AITT*) program to offer university students (SUs) a multi-stage train-the-trainer activity. The *AITT* program blended positive-thinking seminars, AI-empowered robots with emotional support workshops (e.g., robot clothing design and empathetic interactions), and service-learning. During the service-learning stage, SUs could act as instructors or helpers to provide services to primary school students for three months. The *AITT* program can create societal impact and foster an inheritance effect, equipping the next generation with resilience through innovative IT systems. The study addresses three research questions (RQs):

- RQ 1: To what extent does participation in the *AITT* program improve SUs' motivation and engagement?
- RQ 2: To what extent does the *AITT* program reduce DSM-5-based post-traumatic stress symptoms?
- RQ 3: How does serving-learning in the *AITT* program influence SUs' professional competencies?

The contributions of this study are (1) to pioneer the *AITT* program for post-disaster resilience in higher education, (2) to demonstrate active participation and positive learning interest in the *AITT* program, (3) to reveal 10.8% DSM-5 symptom reduction and socio-emotional competency growth, and (4) to show a scalable IT model for community mental health.

II. Method

A. AITT *Program Design*

The *AITT* program trained SUs to serve as trainers, delivering community support (service-learning) to schools in Tai Po,

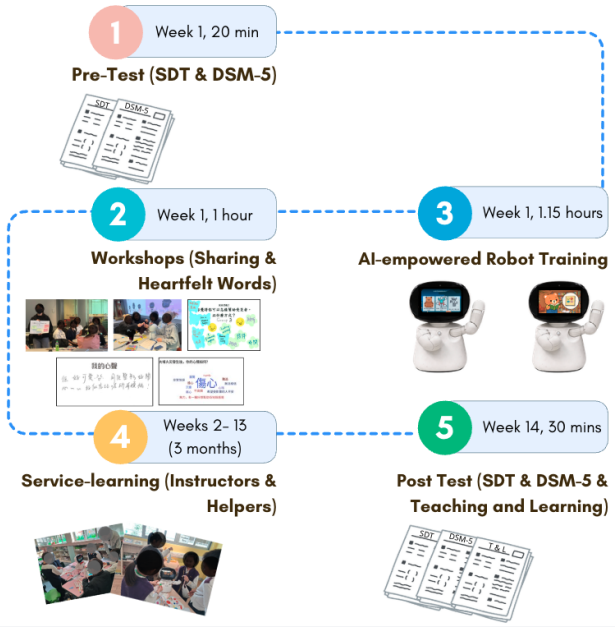

Fig. 1. The overview of the *AITT* program, including (1) pre-test, (2) workshops, (3) training, (4) service-learning, and (5) post-test.

targeting primary school students (PSs) who were indirectly affected by the Wang Fuk Court fire. As shown in Fig. 1, the *AITT* program consisted of a five-stage activity and proceeded as follows:

1) **Stage 1: Pre-Assessment** (Week 1, 20 min)
   - SUs completed pre- SDT and DSM-5 questionnaires.
2) **Stage 2: Positive Psychology Workshop** (Week 1, 1 hour)
   - SUs formed groups of 4–5. They used stickers/papers to express disaster-related feelings and ideas of community support (15 minutes). The group leaders shared their ideas (2–3 min/group). The groups then had 25 minutes to design/dress robot clothing, followed by 2–3 minute concept presentations.
3) **Stage 3: AI-empowered Robot Training** (Week 1, 1.15 hours)
   - Two certified professionals delivered 30-minute hands-on training (system startup, login, mood selection, functions: sing/dance/practice/chat, logout, as shown in Fig. 2). Each group was assigned one social robot for a 30-minute interaction, followed by 15 minutes of Q&A.
4) **Stage 4: Community Service-learning** (Weeks 2–13, 3 months)
   - SUs served as instructors or helpers in primary schools in Tai Po (1–2 sessions/week, 1.5 hours/session), delivering AI-empowered robot and positive thinking (*AIPT*) program to PSs. For the *AIPT* program, PSs attended workshops, received AI-empowered robot training, and completed pre- and post-SDT questionnaires.
5) **Stage 5: Post-Assessment** (Week 14, 30 mins)
   - SUs completed post-SDT, post-DSM-5, and Teaching & Learning questionnaires assessing professional competencies.

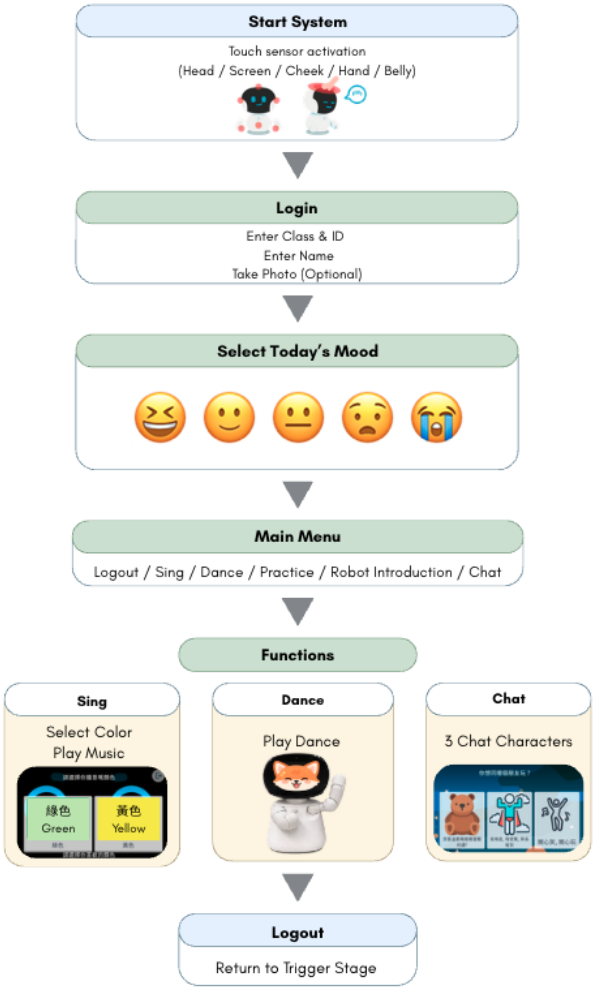

Fig. 2. The overview of the robot training.

a) The SDT Questionnaire: The SDT questionnaire comprised 12 items covering four dimensions:

1) Behavioural engagement (N=3; e.g., "In the *AITT* program, I complete all learning activities"),
2) Emotional engagement (N=3; e.g., "I find the *AITT* program fun"),
3) Cognitive engagement (N=3; e.g., "I fully understand the aim and scope of the *AITT* program"), and
4) Intrinsic motivation (N=3; e.g., "I think the learning process of the *AITT* program is interesting").

Items used a 5-point Likert scale (1 = "Totally disagree" to 5 = "Totally agree"). Each item weighs equally. The questionnaire has been used in the same region [26].

b) The DSM-5 Questionnaire: The PTSD checklist for DSM-5 is a widely used self-report measure to assess PTSD

TABLE I
THE OVERVIEW OF SINGLE-FACTOR ANOVA FOR THE SDT PERFORMANCE. "**" AND "***" DENOTES $p < .01$ AND $p < .001$. THE ACRONYM BE, EE, CE AND IM DENOTE BEHAVIOURAL, EMOTIONAL, COGNITIVE ENGAGEMENT AND INTRINSIC MOTIVATION.

SDT	Test	M	σ	Change	F-value	P-value
BE	Pre	95.00	1.21	3.22	4.60	**
	Post	98.06	0.85			
EE	Pre	93.75	1.28	4.74	9.09	**
	Post	98.19	0.84			
CE	Pre	92.78	1.27	5.54	11.97	***
	Post	97.92	0.88			
IM	Pre	93.33	1.30	5.36	11.23	**
	Post	98.33	0.84			

symptom severity [27]. The DSM-5 questionnaire comprised 20 items (e.g., experiencing recurrent, distressing, and unwanted memories of the stressful event), each scored 0–4 (0 = "Not at all" to 4 = "Extremely"). The score range was 0–80. Scores $\geq$31 typically screen for probable PTSD [1].

c) The Teaching and Learning Questionnaire: The teaching and learning questionnaire assessed four dimensions [7], [28], [29]: (1) teaching efficacy (e.g., controlling disruptive behaviour in the classroom), (2) learning experience and professional growth (e.g., skill in resolving conflicts), (3) reflections (e.g., What challenges did you encounter as a workshop instructor), and (4) suggestions (e.g., What suggestions do you have for improving the workshop). (1) and (2) were measured with a 9-point Likert scale (1 = "Cannot do at all" to 9 = "Can do at all"). (3) and (4) were open-ended questions.

d) Participant: We recruited 48 students (40 females, 8 males), aged 18–44 years (18–24: $N = 33$; 25–29: $N = 10$; 30–34: $N = 2$; 35–39: $N = 2$; 40–44: $N = 1$), with 21 being undergraduates and 27 postgraduates. Inclusion criteria were:

1) holding a bachelor's or master's degree in information technology, psychology, education, inclusive, or special education;
2) studying in Tai Po;
3) having no physical/mental disabilities preventing robot interaction or communication;
4) having prior experience using digital tools (e.g., tablets).

Ethical approval was obtained from the University Institutional Review Board (IRB). Verbal informed consent was secured from all SUs prior to participation. Training participation was entirely voluntary with no compensation provided. Service-learning participation was compensated at the standard rate for student helpers in the local university.

III. FINDING

A. The SDT Evaluation

A single-factor ANOVA revealed statistically significant improvements in behaviour, emotional, cognitive engagement, and intrinsic motivation, as shown in Table I. Behavioural engagement increased by 3.22% (pre-test: $\bar{M} = 95.00, \sigma = 1.21$; post-test: $\bar{M} = 98.06$, $\sigma = .85$; $F = 4.60$, $p < .01$). Emotional engagement rose 4.74% (pre-test: $\bar{M} = 93.75$, $\sigma = 1.28$; post-test: $\bar{M} = 98.19$, $\sigma = .84$; $F = 9.09$, $p < .01$). Cognitive engagement improved by 5.54% (pre-test: $\bar{M} = 92.78$, $\sigma = 1.27$; post-test: $\bar{M} = 97.92$, $\sigma = .88$; $F = 11.97$, $p < .001$). Intrinsic motivation increased by 5.36% (pre-test: $\bar{M} = 93.33$, $\sigma = 1.30$; post-test: $\bar{M} = 98.33$, $\sigma = .84$; $F = 11.23$, $p < .01$).

B. The DSM-5 Measurement

The severity of DSM-5 symptoms decreased 10.77% (pre-test: $\bar{M} = 32.31$, $\sigma = 10.73$; post-test: $\bar{M} = 28.85$, $\sigma = 10.63$; $F = 2.55$, $p = .11$). Although not statistically significant, 28.57% of at-risk students (initial score $\geq$31; pre: $N = 21$, post: $N = 15$) returned to the acceptable range post-program. For those at-risk cases, we may forward to the professional parties (e.g., willingness support centre) for follow-up upon having consent from the participants.

C. The Teaching and Learning Assessment

As shown in Table II, self-efficacy demonstrated moderate-to-high confidence in eight items, with the strongest self-perceived abilities in building students' confidence in workshop performance ($\bar{M} = 6.91$), but lower in controlling disruptive behaviour in the classroom ($\bar{M} = 6.40$). The learning experience showed moderate-to-high confidence in four subscales. Knowledge application exhibited the strongest self-perceived abilities to apply classroom learning to solve real-life problems ($\bar{M} = 6.06$), but weaker abilities to transfer knowledge/skills from one context to another ($\bar{M} = 5.91$). Personal/professional skills manifested the strongest self-perceived abilities in frequent self-reflection ($\bar{M} = 6.83$), but the weakest in confidence in identifying core problems ($\bar{M} = 5.91$). Social commitment demonstrated the strongest self-perceived abilities in caring for four others ($\bar{M} = 7.00$), but the weakest in identifying the needs of vulnerable groups ($\bar{M} = 6.57$). Self-awareness showed the strongest self-perceived abilities in maintaining a positive attitude toward oneself ($\bar{M} = 6.74$), but the weakest in having a clear understanding of one's values and principles ($\bar{M} = 6.57$).

IV. DISCUSSION

A. Impact on Motivation and Engagement

SUs demonstrated statistically significant improvement in motivation and engagement. These positive changes align with SDT's prediction that robot-assisted interactions satisfy autonomy, competence, and relatedness needs. Especially through personalised robot engagement, it can boost cognitive processing and intrinsic interest. The creative elements of the workshop (e.g., AI-empowered robot learning, clothing design, and group sharing) and the role of service-learning likely enhanced relatedness, explaining sustained near-ceiling post-scores ($\bar{M} > 97$). Consistent reduction in variance ($\sigma_{\text{pre}} = 1.3 \rightarrow \sigma_{\text{post}} = .85$) suggests greater response consensus post-intervention. The *AITT* program substantially enhanced SUs' participation.

[1]PTSD Checklist for DSM-5 (PCL-5): https://www.leepsyclinic.com/2025/06/ptsd-checklist-for-dsm-5-pcl-5.html

TABLE II
THE OVERVIEW OF TEACHING AND LEARNING QUESTIONNAIRES.

(1) Teaching Efficacy	M	σ
1 Controlling disruptive behaviour in the classroom	6.40	1.54
2 Motivating disinterested workshop students	6.60	1.26
3 Building students' confidence in workshop performance	6.91	1.40
4 Ensuring student compliance with classroom rules	6.85	1.35
5 Calming disruptive or noisy students	6.49	1.48
6 Establishing classroom management systems for student groups	6.82	1.40
7 Providing alternative explanations/examples for confused students	6.88	1.51
8 Implementing alternative strategies in the classroom	6.65	1.52
(2) Learning Experience		
(2-1) Knowledge Application		
1 Applying classroom learning to solve real-life problems	6.06	1.24
2 Applying/integrating classroom knowledge to address complex problems	5.94	1.30
3 Transferring knowledge/skills from one context to another	5.91	1.40
(2-2) Personal/Professional Skills		
1 Confidence in identifying core problems	6.06	1.26
2 Frequently adapting strategies when situations change	6.23	1.29
3 Skill in building good interpersonal relationships	6.51	1.09
4 Skill in resolving conflicts	6.41	1.21
5 Confidence in leading others toward shared goals	6.34	1.19
6 Frequent self-reflection	6.83	1.20
7 Viewing complex problems from multiple perspectives	6.49	1.22
(2-3) Social Commitment		
1 Contributing abilities to improve the community	6.71	1.13
2 Identifying needs of vulnerable groups	6.57	1.14
3 Respecting needs of people from diverse backgrounds	6.94	0.89
4 Caring about others	7.00	0.85
5 Observing others' feelings and emotions	6.97	0.94
6 Believing caring for those in need is everyone's responsibility	6.89	0.99
(2-4) Self-Awareness		
1 Holding a positive attitude toward myself	6.74	0.93
2 Knowing my strengths and weaknesses	6.71	0.96
3 Having clear understanding of my values and principles	6.68	0.94
4 Always being motivated toward learning	6.71	0.89

B. Reduction in Post-Traumatic Stress Symptoms

The DSM-5 measurement was decreased 10.77% in general though not reaching statistical significance. Also, 28.6% of at-risk students (pre: $N = 21$, score ≥ 31) shifted to acceptable range post-program ($N = 15$). The results revealed a trend toward reduced stress levels among SUs, accompanied by heartfelt messages and group sharing that reflected movement from "heavy-hearted" and "powerless" toward "hope and companionship". This pattern is consistent with literature highlighting train-the-trainer mental health programmes and social support as important for trauma coping [30]–[33].

C. Train-the-Trainer

The evaluation of teaching and learning revealed that SUs demonstrated strong competencies in socio-emotional domains, such as caring for others, self-reflection, and positive self-attitude. This is evident in SUs' feedback, such as students performed very well designing clothes for the robot. However, they performed moderately technical skills, such as knowledge transfer and problem identification. This is also evident in SUs' feedback, such as some students with special needs illiterate. Future iterations should prioritize cognitive/technical skill training. The *AITT* program can promote socio-emotional competencies foundational for resilience work [34], [35]. The positioning of a scalable IT framework for higher education disaster response can achieve comprehensive professional mastery.

V. CONCLUSION

This study provides a preliminary insight into the *AITT* program as a useful IT intervention for post-disaster resilience, significantly enhancing undergraduates' SDT engagement and reducing DSM-5 symptoms. Socio-emotional competencies excelled, though technical skills warrant refinement. The program positions higher education as a resilience hub, training students to support vulnerable communities through scalable AI-empowered support. Future work can focus on cognitive skill modules, SUs outcomes, and AI analytics for nationwide deployment.

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