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Feasibility study of the e-learning version of the "Journey of the Brave:"
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(認知行動療法に基づくユニバーサルな不安予防プログラム「勇者の旅」e-learning版の実施可能性研究)

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Feasibility study of the e-learning version of the “Journey of the Brave:” a universal anxiety-prevention program based on cognitive behavioral therapy

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Abstract

Background School-based cognitive behavioral therapy (CBT) programs could contribute toward preventing anxiety disorders in children. However, setting aside class time for such programs is difficult. Internet-based CBT (I-CBT) is an efficient way to provide CBT. However, studies on I-CBT for anxiety prevention remain scarce, including I-CBT for school-based universal prevention programs. Therefore, we developed an e-learning version of a school-based anxiety-prevention CBT program, “Journey of the Brave,” which was effective in Japan, to make it more flexible and accessible. This study evaluated its feasibility.

Methods We conducted a single-arm study based on 44 parents and children. Children aged 10–12 years took the e-learning program at home. Parents and children responded to a questionnaire three times: before the learning (Pre), after the learning (Post), and three months later (FU: Follow-up). Feasibility was comprehensively evaluated through dropout rates, satisfaction and learning records, and changes in scores on psychological scales assessing anxiety symptoms, emotion-regulation skills, and children’s emotional and behavioral problems.

Results Of the 44 children, 42 started the e-learning, and 32 continued it (dropout rate of 23.8%). Furthermore, 83.9% of the children and 96.8% of the parents responded “agree” or “somewhat agree” regarding overall satisfaction. The parent-rated Spence Children’s Anxiety Scale (SCAS) (SCAS-P) showed a significant decrease between Pre and FU ($p=0.014$, 95% CI = (-9.22, -0.84)); however, the child-rated SCAS (SCAS-C) reduction was not significant ($p=0.08$). The Emotion-Regulation Skills Questionnaire (ERSQ) also increased significantly between Pre and FU ($p=0.045$, 95% CI = (0.18, 18.31)). The Total Difficulties Score of the Strengths and Difficulties Questionnaire (SDQ) decreased significantly from Pre to Post ($p=0.025$, 95% CI = (-3.62, -0.19)); however, it was not significantly different between Pre and FU ($p=0.67$).

Conclusion The e-learning version showed low dropout rates and high satisfaction ratings from parents and children. Moreover, this study did not rule out the possibility that the program reduced children’s anxiety and improved their emotional-regulation skills. Therefore, its potential and feasibility were indicated.

Trial registration UMIN, UMIN000049182, Registered 11 October 2022.

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Keywords Children's anxiety, Universal prevention program, Internet-based cognitive behavioral therapy (I-CBT), e-learning, Gamification, Feasibility study

Background

Anxiety disorders are common mental disorders that present in early childhood [1], with a lifetime prevalence in the range 15%–20% in children and adolescents [2]. Merikangas et al. reported that approximately 1 in 3 adolescents met the diagnostic criteria for an anxiety disorder [3]. Anxiety disorders in childhood predict the maintenance of anxiety and other mental disorders in adolescence [4]. Furthermore, anxiety disorders in adolescence also increase the risk of anxiety and depression in adulthood [5] and predict other mental disorders, such as alcoholism and chronic stress, and life situations, such as social maladjustment and low income [6]. Because anxiety disorders in children and adolescents rapidly increase in the age range 10–19 years [7], childhood prevention and early intervention are necessary [8].

In Japan, anxiety problems are a factor that contributes to the increasing trend of children not attending school. According to a survey conducted by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), approximately half (51.8%) the reasons for non-attendance were “apathy and anxiety,” with the proportion increasing each year [9]. Recent concerns regarding mental-health problems among children have been linked to COVID-19 [10, 11], which has led to increasing interest in addressing anxiety in schools. Meta-analyses have repeatedly confirmed the effectiveness of anxiety-prevention approaches implemented in schools, which are also practical [12, 13]. Prevention approaches include the universal approach, which is not targeted, and an approach for at-risk or symptomatic individuals (Institute of Medicine (US) Committee on Prevention of Mental Disorders, 1994). Because the universal approach does not create labeling and stigmatization [14], its adoption is appropriate for implementing anxiety-prevention programs in schools.

Urao et al. noted that the child anxiety-prevention programs developed in certain countries did not always demonstrate the expected effects in other countries. Subsequently, they developed a school-based universal anxiety-prevention program called “Journey of the Brave,” based on cognitive behavioral therapy (CBT) and tailored to the Japanese cultural and social context [15]. The program was conducted by teachers who received six hours of training via a facilitator's manual [16]. However, it was structured around the work that children did on their own, and the learning content was designed to be understood by teachers' lectures and

workbook reading. Previous studies have suggested that school-based CBT programs are not as effective when delivered by teachers as when delivered by medical professionals [17, 18]. However, the “Journey of the Brave” program demonstrated effectiveness in reducing anxiety among 10- to 12-year-olds even when presented by teachers [16, 19]. However, in Japan, finding sufficient time to provide classes not stipulated by the MEXT was difficult. Furthermore, it placed a heavy burden on teachers in addition to in-class preparation. In addition, many schools suspended the program in 2021 owing to the COVID-19 pandemic, which made it difficult to conduct face-to-face classes. Therefore, we considered ways to reduce the burden on schoolteachers and flexibly provide prevention programs.

Internet-delivered CBT (I-CBT) is an effective treatment for mental disorders in children [20]. I-CBT has received increasing attention owing to raised concerns regarding face-to-face treatment during the COVID-19 pandemic [21]. Although not clearly defined, I-CBT can be broadly classified as guided or unguided and is a self-help format program with documents, audio, and video [22]. I-CBT for anxiety disorders was found to be more cost-effective than regular CBT treatment [23]. Guided I-CBT is comparable to face-to-face treatment in terms of session-completion rates [24], although it requires approximately one-eighth of the therapist's time [25]. Its effectiveness is also comparable to face-to-face sessions for children with anxiety disorders [26, 27]. However, despite meaningful reports on the treatment, studies on I-CBT programs for prevention are scarce and warrant research [28].

We saw potential in an e-learning version of the “Journey of the Brave” program. As it was an individual work-based program with little interaction with teachers or classmates, it was relatively easy to convert written content into screen images. In addition, the Japanese government promoted a project called the Global and Innovation Gateway for All (GIGA) School Initiative [29] in response to the COVID-19 pandemic. Consequently, most elementary and junior high schools now have one computer per student. Thus, if we can offer the program in a self-learning format through I-CBT, students can learn at their own pace at home or wherever they like, with teachers guiding them when necessary. If sufficient class time is unavailable, the program can be implemented flexibly, such as during self-study time, which may reduce the burden on teachers.

A recent study on the “Journey of the Brave” reported reduced anxiety scores even when the program was divided into short classroom activities of 20 min. This demonstrated that the program was effective without necessarily using 45–50 min of classroom time at once [30]. Thus, we developed an e-learning version that allowed students to view class videos and answer work and tests over the Internet to make it more flexible and lower the burden on teachers owing to school implementation. “Journey of the Brave” is a school-based universal prevention program, and we envision an e-learning version also being offered in schools. However, simultaneously, fundamental verification is required to ensure that the e-learning version works correctly and that children can operate and understand it themselves as self-help material. Therefore, we aimed to evaluate the feasibility of the e-learning version at home rather than at school.

The “Journey of the Brave” has been evaluated using the Spence Children’s Anxiety Scale (SCAS, a symptoms-rating scale) in previous studies, despite its being a prevention program. However, we focused on emotion-regulation skills in this study because we believe it is necessary to evaluate prevention effects in multiple dimensions. Emotion regulation plays an important role in the onset and maintenance of anxiety disorders [31], and emotion-regulation skills predict future improvement in anxiety severity [32]. A report shows that CBT improves emotion-regulation skills prior to improvement in social-anxiety symptoms [33]. Improvements in emotion-regulation skills promote mental health and increase the effectiveness of psychotherapy [34], and thus emotion-regulation skills are a promising measure for evaluating the preventive effects of interventions.

Our hypothesis was that even if the “Journey of the Brave” were provided as an e-learning program on a computer, children would accept and complete the program without problems, showing an effect not only in reducing anxiety but also in improving emotion-regulation skills. We also expected an effect on children’s emotional and behavioral problems in addition to that on anxiety.

Methods

Aim and setting

This study evaluated the feasibility of a newly developed e-learning version of “Journey of the Brave” via a single-arm intervention trial with no control group. Both parents and children participated. The intervention was provided only to the children; however, both completed a questionnaire to evaluate its feasibility. The study was approved by the Ethics Review Committee of Chiba University School of Medicine. The study was pre-registered

at the University Hospital Medical Information Network (UMIN000049182).

Participants and recruitment

Participants were fifth- and sixth-grade students (aged 10–12 years) enrolled in regular classes. The same parent was required to answer all the questionnaires. Because this was a preventive intervention program, we excluded children who were not attending school, were enrolled in special-needs classes, were diagnosed with developmental disabilities or mental disorders, or attended psychiatric hospitals. We recruited participants through the official “Journey of the Brave” website and flyers distributed to approximately 1,500 children through several schools in the Chiba and Ibaraki prefectures from August to September 2022. We asked the Board of Education of Chiba Prefecture and Chiba City for their cooperation in recruiting schools to distribute the flyers. We also sent the information by direct mail to teachers who had previously taken the “Journey of the Brave” training. In the flyer, we included the aim and overview of the study, eligibility and exclusion criteria, and the computer and network requirements necessary to take the e-learning program. Applications and informed consent forms were available on the website, accessible via a QR code on the flyer. Participants could apply only if they had read and agreed to the written instructions. We checked whether they met the eligibility criteria; we informed them that they could not participate in this study if they did not meet the eligibility criteria or if they met the exclusion criteria. Furthermore, the children’s assent document, written in plain language, was posted on the website to ensure that children were not forced to participate only because of their parents’ wishes, and we also made it possible to check the children’s own willingness to participate when they applied for the program.

Intervention

We developed an e-learning version to replicate the classroom experience on a computer. Learning modules, called stages, comprised eight learning stages and a review stage, similar to the original (Table 1). Primarily, participants watched the videos and answered the questions in a workbook, with between one and five works per stage. Each stage included one core work and check tests that participants answered on the e-learning system so that the administrator could review the content. Furthermore, homework was provided for each stage. We asked participants to allow at least one week between two stages to work on homework, with a maximum study period of six months. However, we left the actual learning cycle up to them, which allowed for flexibility. In addition, although the e-learning system was designed

Table 1 Contents by session

Session	Content
1	Understanding of four basic feelings
2	Monitoring feelings of anxiety and setting goals
3	Body reactions and relaxation
4	Anxiety-level stages and stair-step exposure
5	Anxiety cognition model
6	Identify cognitive distortions and coping with rumination
7	Cognitive restructuring when anxious
8	Assertiveness skills to reduce social stress
9	Review and summary

so that participants could not proceed to the next stage unless they had completed the previous video or work, for homework assignments, participants were allowed to proceed even if they had not submitted the work. The e-learning version, which required children to learn at their own pace and on their own initiative, had various features to encourage learning (Fig. 1). We employed a system whereby participants earned points on completion of a stage and submitting the homework results. Participants earned new items and characters as they accumulated points and progressed through the levels. Participants could choose and display any characters acquired on the learning screen. We also sent a reminder message with content after they had completed stages 1, 3, and 8 to encourage continued learning. Moreover, we implemented a feature that allowed participants to ask questions when unsure. These features were developed based on previous research, which demonstrated that rewards, personalization, reminders, and a supportive environment from others in I-CBT programs increased children’s adherence [35].

Procedure

We sent an e-learning account for each participating parent and child to the parent’s e-mail address. When the children first logged onto the website to begin learning, we reaffirmed their assent by displaying an assent document that stated that they wished to learn on their own initiative and could withdraw at any time. Parents and children responded to a questionnaire that comprised the evaluation indicators three times: before the learning began (Pre), at the end (Post), and three months later (FU: Follow-up). We designed the questionnaire to be integrated into the learning process so that it would be clear when to respond. The first video was available after children had responded to the pre-study questionnaire. We sent an e-mail to the parents when they had to respond to the questionnaire based on their children’s

learning progress. In addition, we set up the system so that parents could not only respond to the questionnaire but could also view the class videos so that they could see what their children would be learning. During the study period, we checked on the children’s progress approximately once a week. If there was no access for > 10 days, we sent an e-mail to the parents to confirm that they were still interested in participating.

Measurements

The primary outcome was the dropout rate. We evaluated whether children completed the program even in its e-learning version. We also comprehensively evaluated its feasibility, which included the results of satisfaction questionnaires rated on a 4-point scale and learning scores as secondary outcomes. In addition, psychological-scale scores were also used as secondary outcomes. We cannot discuss the effect of the intervention as this was a single-arm trial. However, we considered how anxiety and other scores changed over the study period as an essential feasibility component.

SCAS

The SCAS assessed the severity of anxiety disorders in children [36], and the Japanese version has demonstrated reliability and validity [37]. As parental ratings were also helpful in assessing children’s anxiety [38], we used both the scale on which children answered themselves (SCAS-C) and that on which parents answered regarding their children (SCAS-P) [39]. Previous studies have confirmed that classes with “Journey of the Brave” reduce the mean scores on the SCAS-C [16, 19, 30]. The SCAS-P was also used in studies during the program’s early development and found significant reductions [15]. The reliability coefficient (Cronbach’s α) for the Japanese version is $\alpha=0.94$ for the SCAS-C [37] and $\alpha=0.96$ for the SCAS-P [39]. For this study’s sample, $\alpha=0.89$ for the SCAS-C and $\alpha=0.91$ for the SCAS-P.

Emotion-Regulation Skills Questionnaire (ERSQ)

The ERSQ is the English version [40] of the Selbstestimation Emotionaler Kompetenzen (SEK-27) [41]. The Japanese version demonstrated not only reliability and validity but also that the nine subscales were broadly classified into two categories in a previous study: “awareness and understanding” and “acceptance and engagement” [42]. We used this scale as a secondary outcome to evaluate prevention effectiveness and observed children’s changes before and after e-learning in multiple dimensions. The Japanese version was developed based on data on those 18 years and older; thus, we used it with supplementary explanations added for difficult words for elementary-school children. The reliability coefficient

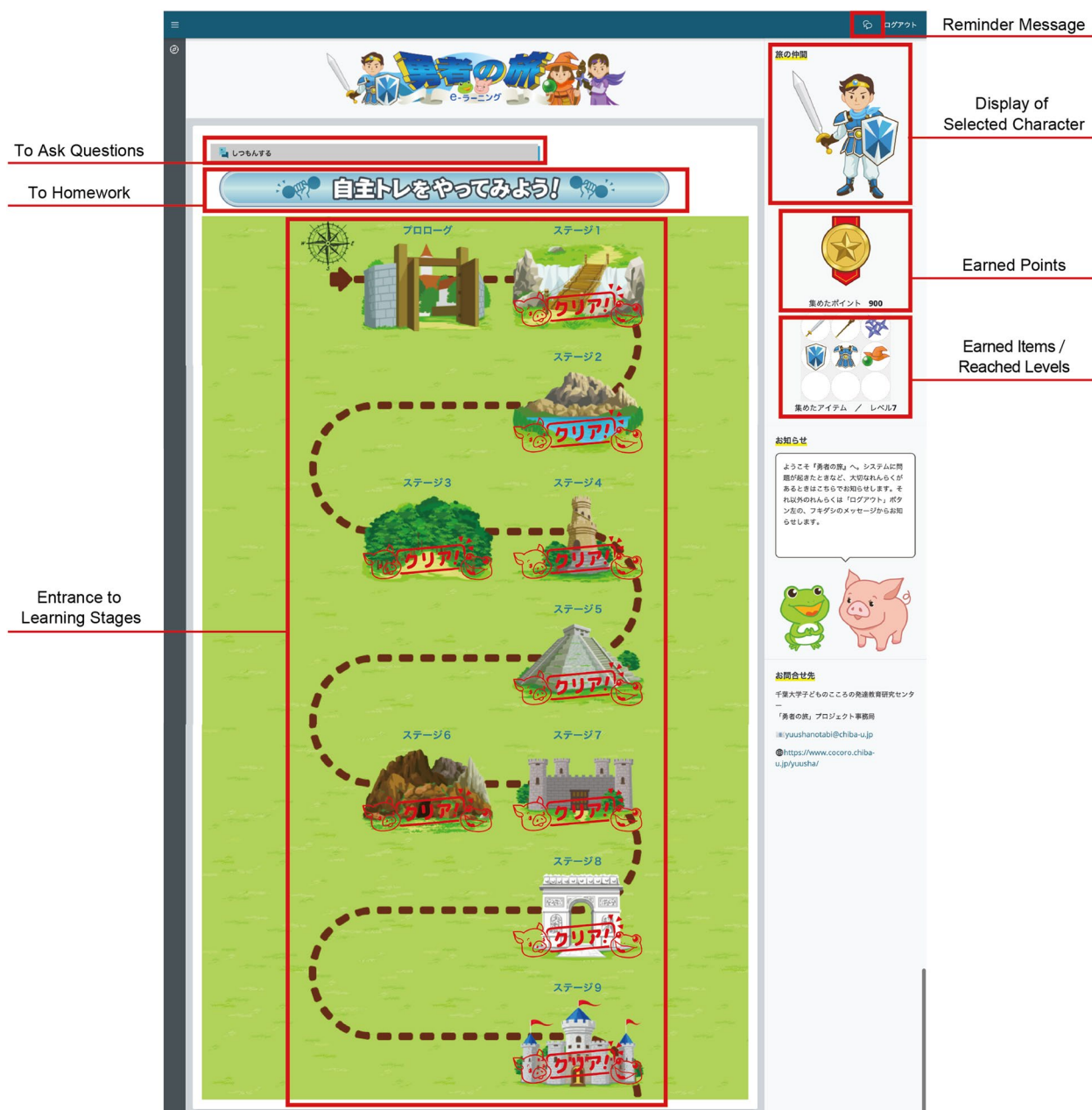


Fig. 1 Learning home screen and features

(Cronbach's α) for the Japanese version in the non-clinical group was $\alpha=0.95$ for "awareness and understanding" and $\alpha=0.96$ for "acceptance and engagement" [42]. Cronbach's α for the total ERSQ was $\alpha=0.93$, with $\alpha=0.90$ and $\alpha=0.89$ for "awareness and understanding" and "acceptance and involvement," respectively.

Strengths and Difficulties Questionnaire (SDQ)

The SDQ comprised 25 items on five subscales that assessed children's emotional symptoms, conduct

problems, hyperactivity/inattention, peer-relationship problems, and prosocial behavior [43]. The reliability and validity of the Japanese version, whereon parents responded regarding their children's anxiety, have been demonstrated [44]. The Total Difficulties Score (TDS) (the sum of the scores without the prosocial behavior subscale) has a maximum of 40. We used the TDS to observe the children's changes as perceived by the parents before and after the e-learning in multiple

dimensions. Cronbach's α for the Japanese version of the TDS is $\alpha = 0.77$ [44]; in this study, $\alpha = 0.77$.

Analysis

The dropout rate was calculated as the percentage of children who started the program and withdrew during the 6-month study period. We did not consider those who did not complete the program during the study period as they could continue it. Whenever there was no access for <10 days, we confirmed their intention to continue through the parents. Regarding satisfaction, we obtained descriptive statistics from the participants and various learning records (e.g., checking test scores and the number of homework assignments submitted). We analyzed continuous variables recording changes in psychological-scale scores from Pre to FU via a repeated-measures analysis of variance (ANOVA). IBM SPSS Statistics version

28 was used for repeated measures ANOVA, and effect sizes were calculated using G*Power 3.1 [45].

Results

Dropout rate

Of the 46 parents and their children who agreed to participate, we excluded two pairs as one child was younger than those in the target grades and another withdrew before the Pre-questionnaire. Therefore, 44 pairs participated (Fig. 2 and Table 2). Of these, four were single-mother families. Most (19 (43.2%)) had a household income of >9 million yen (\$60,000). Furthermore, 34 (77.3%) fathers and 31 (70.5%) mothers had completed university or graduate school. Parents' average age was 44.4 years (38–52 years); only two (4.5%) were fathers and 42 (95.5%) were mothers. Because two children responded to the Pre-questionnaire and withdrew

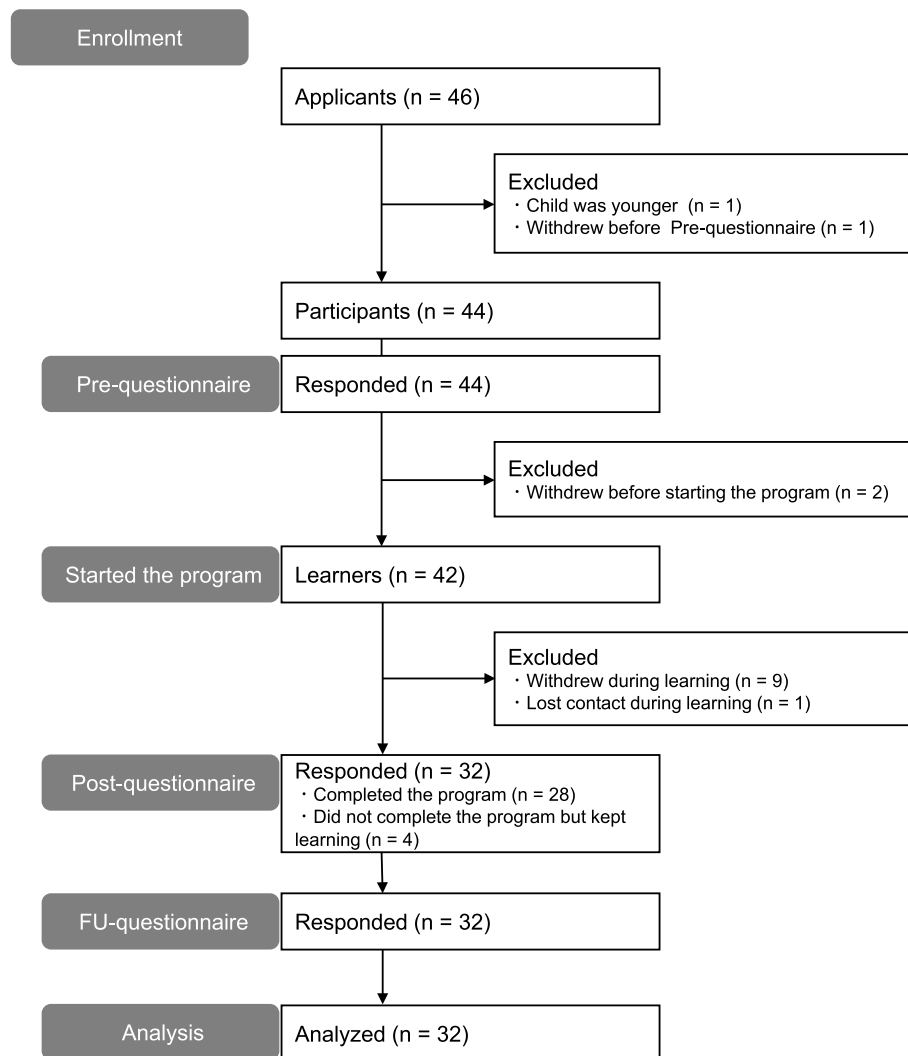


Fig. 2 Flow-chart displaying the number of parent-child pairs at each time point and sample count

Table 2 Participants' demographic data

		Participants (n = 44)
Children's Information		
Sex	Female	25 (56.8%)
	Male	19 (43.2%)
Grade	5th	30 (68.2%)
	6th	14 (31.8%)
Reports from Parents		
Respondent	Father	2 (4.5%)
	Mother	42 (95.5%)
Average Age of Respondents		44.4 (38–52)
Family Composition	Parents and child	40 (90.9%)
	Fatherless family	4 (9.1%)
Household Incomes	< 3 million yen	2 (4.5%)
	3–6 million yen	12 (27.3%)
	6–9 million yen	11 (25.0%)
	> 9 million yen	19 (43.2%)
Father's Final Education	Junior high school	1 (2.3%)
	High school	4 (9.1%)
	Vocational schools, junior colleges, etc	5 (11.4%)
	University or graduate school	34 (77.3%)
Mother's Final Education	Junior high school	0 (0%)
	High school	6 (13.6%)
	Vocational schools, junior colleges, etc	7 (15.9%)
	University or graduate school	31 (70.5%)

without starting the e-learning program, 42 children, 29 (13 boys and 16 girls) and 13 (six boys and seven girls) in the fifth and sixth grades, respectively, actually started the e-learning. Of these, 9 dropped out during their learning while one lost contact (dropout rate of 23.8%). Of the remaining 32 children, 28 completed the entire program, and the remaining four continued learning throughout the period and completed at least five or more stages (one completed five stages, one completed seven stages, and two completed eight stages). All 32 pairs also completed the Post- and FU questionnaires.

Satisfaction and learning records

Figure 3 presents the details of the Post and FU questionnaire responses regarding satisfaction. In total, 27 children (27/32, 84.4%) and 30 parents (30/31, 96.8%) and 26 children (26/31, 83.9%) and 30 parents (30/31, 96.8%) answered “agree” and “somewhat agree” to the overall satisfaction question in Post and in FU, respectively. The 28 children who completed all stages took an average of 13.6 weeks for completion (measured from Stage 1 completion owing to the different time durations between questionnaire responses and starting Stage 1). The average score for the 29 children who answered the comprehension test (correct/incorrect questions) on all

the content learned, which was provided in the last stage (Stage 9), was 14.6 out of 16 points (11–16, SD = 1.21). The average number of times they submitted their homework was 8.6 times (of 15). Furthermore, there was a wide variation in their commitment to homework from 0 to 15 times (SD = 6.28).

Changes in psychological scales

Table 3 presents the mean scores and standard deviations for each psychological scale from Pre to FU and results from repeated-measures ANOVA. The 32 pairs who continued the program were analyzed. Data on children with missing items or responses were excluded. The mean SCAS-C score decreased by 4.37 points from Pre to FU, with a moderate to large effect size ($f = 0.320$); however, there was no significant difference between the three time points ($p = 0.08$) and power was inadequate at 0.504. Meanwhile, the mean SCAS-P score decreased significantly by 5.03 points from Pre to FU ($p = 0.002$), with a large effect size ($f = 0.481$) and adequate power (0.922). Multiple comparisons with Bonferroni correction indicated a significant difference between Pre and FU ($p = 0.014$, 95% CI = (-9.22, -0.84)) and Post and FU ($p = 0.004$, 95% CI = (-7.50, -1.25)) for SCAS-P (Fig. 4). The mean ERSQ score increased significantly

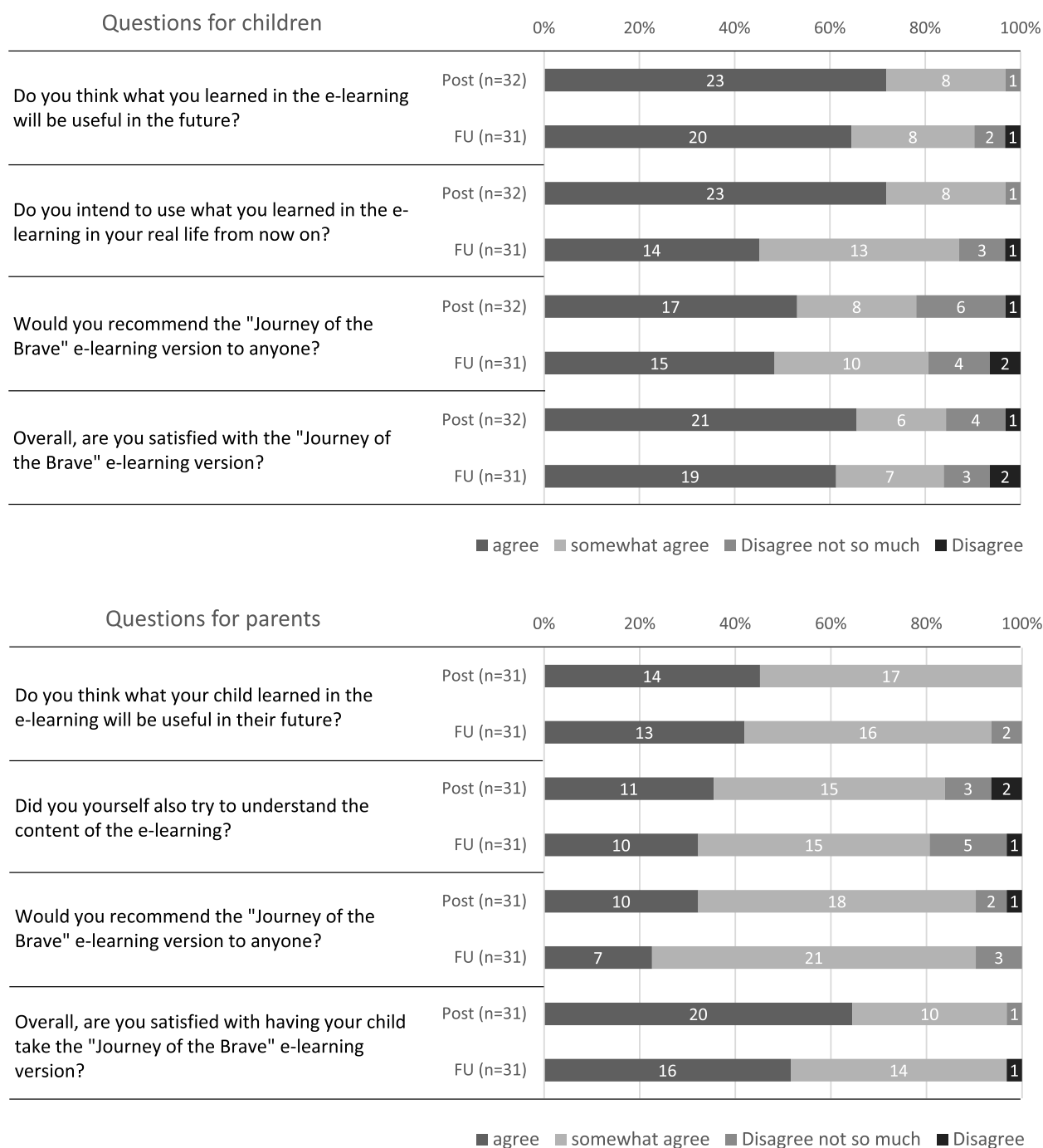


Fig. 3 Results of the questionnaire responses regarding satisfaction (Post and FU)

by 9.24 points from Pre to FU ($p=0.041$), with a moderate to large effect size ($f=0.348$). The observed power was 0.615. Multiple comparisons indicated a significant difference between Pre and FU ($p=0.045$, 95% CI=(0.18, 18.31)) (Fig. 5). The mean SDQ-TDS score rated by parents decreased by 1.9 points from Pre to

Post, and increased by 0.9 points from Post to FU. There was a significant difference between the three time points ($p=0.029$), with a moderate to large effect size ($f=0.348$) and observed power of 0.664. However, multiple comparisons indicated no significant difference between Pre and FU ($p=0.665$), although there was a

Table 3 Psychological scale scores at each time point and results of repeated-measures ANOVA

Scales	Pre, Mean (SD)	Post, Mean (SD)	FU, Mean (SD)	F	P	Effect size		Observed Power
						Partial η^2	f	
SCAS-C (n = 27)	25.63 (12.26)	25.15 (14.50)	21.26 (13.06)	2.65	0.080	0.093	0.320	0.504
SCAS-P (n = 32)	17.69 (10.25)	17.03 (7.95)	12.66 (7.52)	7.18***	0.002	0.188	0.481	0.922
ERSQ (n = 29)	63.45 (20.58)	68.38 (20.51)	72.69 (18.50)	3.39*	0.041	0.108	0.348	0.615
SDQ-TDS (n = 32)	11.59 (5.80)	9.69 (5.87)	10.59 (5.40)	3.74*	0.029	0.108	0.348	0.664

SCAS-C/P Spence Children's Anxiety Scale Child/Parent version, ERSQ Emotion-Regulation Skills Questionnaire, SDQ-TDS Strengths and Difficulties Questionnaire Total Difficulties Score

* $p < .05$

*** $p < .005$

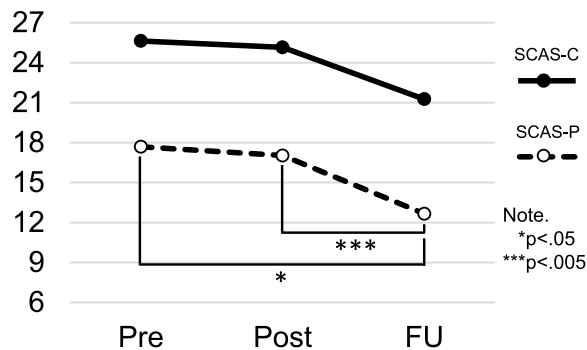
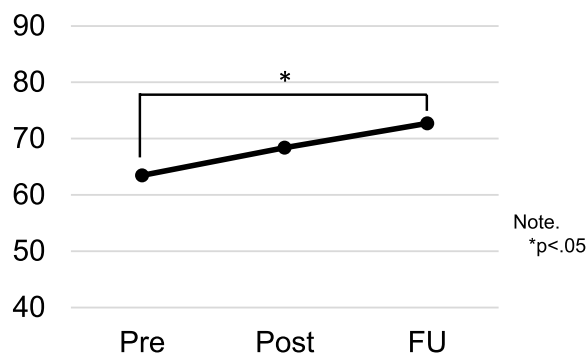
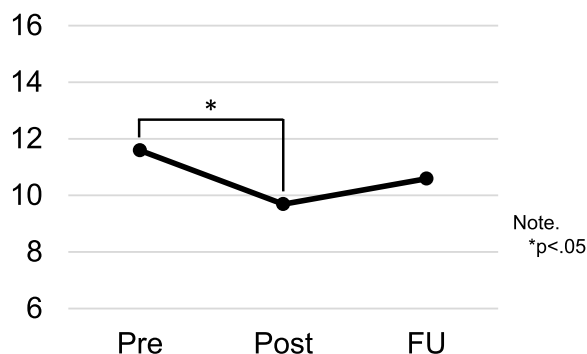

Fig. 4 Changes in the mean SCAS-C/P scores

Fig. 5 Changes in the mean ERSQ scores

Fig. 6 Changes in the mean SDQ-Total difficulties scores

Table 4 Evaluation of e-learning features

	Rating out of 10	
	Average score for children	Average score for parents
Earn points	7.7	7.7
Obtain items and characters	8.0	8.4
Choose characters by themselves	8.0	8.3
Can do "self-training"	6.6	6.7
Receive reminder messages	7.3	7.5
Ask questions	8.2	7.2

significant difference between Pre and Post ($p = 0.025$, 95% CI = (-3.62, -0.19)) (Fig. 6).

Furthermore, previous research found that the high-anxiety group with SCAS-C scores of 45 or higher (top 10%) showed a significant decrease in scores compared to the low-anxiety group [16]. However, in this study, of the four children (9.1%) with SCAS-C scores of 45 or higher at Pre, two children and one child dropped out before the learning began and at Stage 1, respectively. Thus, only one child in the high-anxiety group was included in the analysis.

Evaluation of E-learning features

In addition to satisfaction, the questionnaire elicited responses to rate various features on a scale from 1 to 10. Table 4 presents the average rating scores for each of the e-learning features. The reward and personalization features, which allowed users to obtain items and characters and choose which characters to display, respectively, received relatively high evaluations. The homework feature, "self-training," received the lowest evaluation. The question feature received the highest evaluation, while the actual number of questions was limited to six from four children. Some of the free-text feedback included suggestions for improvement, such as, "It would be better if it were more game-like." However, many of those were positive, such as, "It was interesting and informative,"

“I now understand how to deal with anxiety,” and “The explanations were detailed and easy to understand.”

Discussion

Feasibility

We developed and evaluated the feasibility of an e-learning version of the “Journey of the Brave” anxiety-prevention program for children in Japan. The dropout rate was 23.8%. Of the participants, 76.2% and 66.7% completed at least five and all the stages, respectively. Furthermore, 83.9% of the children and 96.8% of the parents responded positively to the overall satisfaction level at FU. A meta-analysis of 64 trials that examined the effectiveness of I-CBT for patients with depression or anxiety disorders found median adherence and satisfaction rates of 66% and 86%, respectively [25]. The BRAVE Self-Help, an open-access online program available to all Australian children aged 7–17, reported moderate levels of satisfaction, and 44% of the children aged 7–12 completed at least 3 out of 10 sessions in a study based on a sample of highly anxious children [46]. In a study based on children aged 13–17 years using the Mood GYM, an Internet-based intervention aimed at preventing depression and anxiety, reported that in community samples enrolled through the official website, 89% completed none or only one module, whereas in a monitored school setting, 55% completed 3 out of 5 modules [47]. In addition, the Cool Little Kids Online, a parenting program aimed at early prevention of children at high risk of anxiety, although the target population was parents of children aged 3–6 years, 86% positively evaluated the program’s usefulness; however, all 8 modules were completed by 38.9% [48]. Compared to these studies, the results of this study indicate a low dropout rate and high adherence as the I-CBT program focused on children’s anxiety, even when considering that the recruitment of participants was distributed through the school and cooperation and involvement of parents, such as responding to questionnaires.

Regarding changes in psychological-scale scores, a non-significant decrease was observed in the mean score for the SCAS-C; however, a significant decrease was observed from Pre to FU, with a large effect size and adequate power for the SCAS-P. These results are similar to those of a previous study that conducted in-person intervention [15]. Although a certain amount of effect size was observed for the SCAS-C, its power was inadequate for the current sample; however, it was possible that an e-learning version could also significantly reduce the mean score if a larger sample was included, similar to the original program. Meanwhile, noting that most parents and children in the high SCAS-C-scoring group dropped out before or early in the learning, it is possible that there was little room for improvement as

the children included in the analysis had relatively low anxiety. A study examining trajectories of anxiety change during BRAVE Self-Help attendance reported that anxiety scores as measured by the CAS-8 (an 8-item scale adapted from the SCAS [49]) were significantly reduced in children who completed at least 6 of 10 sessions (Cohen’s $d=0.88$); however, the high anxiety-severity group completed fewer sessions than the moderate group [50]. It is not clear what caused most of the children in the high-anxiety group to drop out before or early in the learning in this study. However, March et al. reported that Stepped-care, in which participants who showed little improvement during the I-CBT sessions were moved to therapist-guided I-CBT, was as effective (Cohen’s $d=1.16$ by SCAS-C before and 12 weeks after treatment) and satisfying as therapist-guided I-CBT from the beginning [51]. We must clarify what caused the early dropout in the “Journey of the Brave” e-learning version and consider how we can help the high-anxiety group continue in the program. We expect that the “Journey of the Brave” e-learning version, moving forward to the implementation step in schools, will be among the solutions to this problem.

We also observed a significant increase in the mean ERSQ scores from Pre to FU, which indicated that children’s emotion regulation skills increased before and after the program’s implementation. The e-learning program could have promoted children’s emotion-regulation skills. Although the change in SCAS-C was not significant, the improvement in the children’s own subjective ratings of emotion-regulation skills, which may promote mental health and enhance the effectiveness of psychotherapy [34], further supports the program’s effectiveness in preventing anxiety. While many digital interventions, including those in game form, have focused on children’s and adolescents’ emotion regulation and have shown effectiveness in reducing anxiety and negative emotional experiences, the observed improvements in emotion-regulation skills themselves were mixed, and even the significant one had a small effect size (Hedges’ $g=0.026$) [52]. The emotion-regulation skill-improvement effects of the “Journey of the Brave” e-learning version must be repeatedly evaluated because the observed power was somewhat inadequate. Moreover, a study design that includes longer-term follow-up must be considered to determine whether the improvement in emotion-regulation skills actually leads to the prevention of anxiety. However, despite this study’s few high-anxiety groups in contrast to these previous studies, a significant reduction in SCAS-P scores and improvement in ERSQ scores, with moderate to large effect sizes, as well as a low dropout rate and high satisfaction were observed. These results support the feasibility of this e-learning program.

The mean SDQ-TDS, which indicated difficulties stemming from children's emotional and behavioral problems, showed a significant decrease from Pre to Post. However, the decrease was not maintained in FU. It was possible that, because this program was essentially an anxiety-prevention education program, its other problem-solving effects could have been limited. Thus, continuous verification with a larger sample size and adequate power is required for a more accurate reference.

Feature improvements

These findings indicate that the design of a series of features based on rewards and personalization, such as earning points and level progression through learning, adding items and characters via progression, and selecting favorite characters to display, were highly rated. Conversely, the features for receiving messages were rated less highly. Children had to click several times to reach the dedicated message box to see the messages. In addition, a researcher had to manually send the messages as the system could not automatically send prepared messages owing to system limitations. We do not want teachers to be burdened with sending messages, especially when conducting e-learning in a school environment. Thus, ensuring that a message is automatically displayed when each stage is completed is a future requirement. We were also disappointed that the homework feature, an essential component for CBT, was not rated very highly and polarized the children into two groups: those who worked on very little and those who worked on almost everything. Because homework-implementation data have not been available for the "Journey of the Brave" conducted in-person at schools, it may be beneficial to investigate the association between homework implementation and its effectiveness in future studies. Nevertheless, considering ways to ensure that children will want to continue doing homework may improve the quality of the program.

Limitation

This study has several limitations. First, the sampling issue: The participants were highly motivated parents and children who willingly took the program, which might have influenced the low dropout rate and effectiveness of the program as they were more active than the classroom population in which the program had traditionally been implemented. Furthermore, although the largest number of participants were from families with household incomes exceeding 9 million yen, the average annual income of households with children in Japan was 7.85 million yen [53]. Although over 70% of both parents who participated had a university or graduate school education, only 37.6% of men and 22.7% of women in their 40s in Japan had a university or graduate school education

[54]. Hence, children who participated were raised by parents with high incomes and educational backgrounds, which might have influenced the children's lifestyle and attitudes toward e-learning. It should be noted that this study had sampling bias, and the results cannot be generalized. Second, we cannot inherently address the contribution of e-learning to changes in scores on psychological scales, including the anxiety preventive effect, as this was a single-arm study with no control group. We cannot assert that the positive changes were caused by e-learning, although we found significant positive changes in the SCAS-P and ERSQ scores between Pre and FU. Furthermore, the reliability and validity of the Japanese version of the ERSQ has yet to be confirmed among elementary-school students. However, we found no reason to doubt the feasibility of the e-learning version as we detected no adverse changes in any psychological scales, such as an increase in the mean anxiety score after the intervention. Future study designs that include long-term follow-up with larger samples must be considered to more accurately refer to prevention effects on children with less apparent anxiety problems.

Conclusion

The study evaluated the feasibility of a newly developed e-learning version of the "Journey of the Brave" CBT-based anxiety-prevention program using 44 parent-child pairs. The study observed low dropout rates and high satisfaction from parents and children. We confirmed a specific feasibility, as it did not show any results contrary to expectations regarding reducing anxiety or improving emotional-regulation skills. Verifying whether the e-learning version can show preventive effects of anxiety on the originally intended target population via comparison with a control group in a school environment is necessary.

Abbreviations

CBT	Cognitive behavioral therapy
I-CBT	Internet-based cognitive behavioral therapy
SCAS	Spence Children's Anxiety Scale
ERSQ	Emotion-Regulation Skills Questionnaire
SDQ	Strengths and Difficulties Questionnaire
MEXT	Ministry of Education, Culture, Sports, Science and Technology
ANOVA	Analysis of variance

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Further reading

Institute of Medicine (US) Committee on Prevention of Mental Disorders. Reducing Risks for Mental Disorders: Frontiers for Preventive Intervention Research. Washington District of Columbia: National Academies Press; 1994.

Authors' contributions

SO contributed to all aspects of the study design, e-learning development, data collection, statistical analysis, and manuscript preparation. YU oversaw the study design and e-learning development and provided advice in manuscript preparation. KF made major contributions to the study design

and statistical analysis. TK contributed to the study design. SI contributed to data collection and manuscript revision. ES reviewed the study design and the manuscript. All authors read and approved the final manuscript.

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Data availability

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The protocol was approved by the Ethics Review Committee of Chiba University School of Medicine (Registration number: M10352) in accordance with the Ethical Guidelines for Medical and Health Research Involving Human Subjects as well as the Declaration of Helsinki. Informed consent forms were available on the web which were filled out by the parents. A plain-language children's assent document was also available on the web to ensure that both the parents and the children were willing to participate.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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