Research Article

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Effect of Emotion-Centered Problem-Solving Therapy Program plus LINE application on Depression among Late Adolescents

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Abstract

Background: Depression among late adolescents is a major mental health concern that affects adolescents, families, and society. **Objective:** The aim of this quasi-experimental study was to examine the effect of Emotion-Centered Problem-Solving Therapy Program plus LINE Application on depression among late adolescents. **Methods:** The sample consisted of Matthayom 4–6 upper secondary school students in Rayong Province with mild to moderate depression. They were recruited through simple random sampling and later assigned to either the experimental group (n = 20) or control group (n = 20). The experimental group received the Emotion-Centered Problem-Solving Therapy Program plus LINE Application for six sessions over three weeks. The control group received routine school care. Data were collected at pretest, posttest, and one-month follow-up using a demographic questionnaire and the Thai version of the Center for Epidemiologic Studies Depression Scale (CES-D). The CES-D showed acceptable internal consistency (Cronbach's alpha = .83). Data were analyzed using descriptive statistics, two-way repeated-measures ANOVA, and Bonferroni pairwise comparisons. **Results:** The experimental group demonstrated significantly lower depression scores than the control group ($F(1, 38) = 7.374$, $p < .05$). Depression scores also showed a significant change over time ($F(1.519, 57.719) = 11.553$, $p < .001$), and a significant group-by-time interaction was observed ($F(1.519, 57.719) = 6.115$, $p < .01$). In the experimental group, depression

scores decreased significantly from pretest (Mean = 18.35, SD = 1.73) to posttest (Mean = 14.90, SD = 3.28) and one-month follow-up (Mean = 14.40, SD = 3.93). **Conclusion:** The findings suggest that this program helps reduce depression among late adolescents with mild to moderate depression, with the reduction in depressive symptoms maintained at the one-month follow-up.

Keywords: Late adolescents, Depression, Emotion-Centered Problem-Solving Therapy, LINE application**,** School Mental Health

What was Known

- Depression remains a prevalent and important mental health concern among adolescents.
- Depression in adolescents is not solely caused by life problems but also influenced by negative emotions, maladaptive perceptions of problems, and ineffective problem-solving skills.
- Given the increasing use of LINE application, further research is needed to develop and evaluate technology-based problem solving plus emotional management interventions for adolescents.

What's New and Next

- Strengthening emotional regulation skills, fostering positive perceptions of problems, and promoting rational problem-solving approaches contribute to reducing depressive symptoms among adolescents.
- The integration of the LINE application with Emotion-centered problem-solving therapy reflects an approach appropriate for Thai adolescents in the digital age.
- Depression in late adolescents can be reduced through LINE application with Emotion-centered problem-solving therapy.
- Further studies are required to establish the effectiveness of Emotion-Centered Problem-Solving Therapy Program plus LINE Application.

Introduction

Depression in late adolescents is a significant and increasing mental health problem. Between 2021 and 2025, an estimated 20 million adolescents aged 15–19 worldwide experienced depression, representing 3.4% of the adolescent population, and depression was the third leading cause of death among adolescents globally [(1)]. A systematic review and meta-analysis reported a global prevalence

of 34% for elevated self-reported depressive symptoms among adolescents [2]. Studies have also reported depressive symptoms among adolescents at 23.00% in China [3], and 57.60% in Vietnam [4]. In Thailand, the rate is as high as 63.86% [5]. A previous study reported that depressive symptoms increased from 24.15% among middle school students to 28.23% among high school students [6]. Late adolescents face multiple risk factors, including physical and hormonal changes affecting emotional regulation [7], academic expectations and competitive university entrance examinations [8], and the impact of social media on depression (β = .219, $p < .001$) [9]. In Rayong Province, 46.40% of late adolescents were reported to experience depression [10], indicating that depression remains an important concern in the local context and highlighting the need for appropriate care.

Adolescent depression affects not only individuals but also has widespread impacts on families and society. Adolescents with depression often engage in risky behaviors such as internet addiction and substance abuse [11], and in severe cases, it can lead to suicide attempts. Reports indicate that high school students have a high risk of suicide, as high as 14.04% [12]. Furthermore, mental health conditions during adolescence can adversely affect educational functioning and may have consequences extending into adulthood, limiting future opportunities. Depression also contributes to substantial societal and economic burden through impaired functioning and reduced productivity [1]. Although there are currently various approaches for treating depression in adolescents, for mild to moderate depression, the Royal College of Pediatricians of Thailand recommends Problem-Solving Therapy (PST) as a primary approach [13]. PST was originally developed by D'Zurilla, Nezu, and Maydeu-Olivares [14], with empirical evidence supporting its effectiveness in reducing depression in late adolescents [15,16].

Although PST is supported by evidence of its effectiveness in reducing depression, traditional PST primarily focuses on cognitive processes and systematic problem solving. PST may reduce depressive symptoms by promoting a positive problem orientation and systematic problem-solving skills, helping individuals cope more effectively with stressful problems. However, emotions can influence problem-solving abilities, particularly when individuals experience negative emotions or emotional overload, which may hinder rational thinking, decision-making, and problem solving. For this reason, PST was further developed into Emotion-Centered Problem-Solving Therapy (ECPST), which systematically integrates emotion management into the problem-solving process [17].

In this study, the LINE application was integrated with ECPST as a supportive tool to promote continuity of skills practice among late adolescents. LINE is widely used among Thai secondary

school students; a nationally representative survey reported that 88.6% of current social media users used LINE [18]. The LINE application was used to support content review, homework submission, and activity recording between therapeutic sessions, thereby facilitating continued skills practice throughout the program. Thus, LINE served as a supportive tool for the ECPST program rather than as a separate therapeutic intervention.

Although problem-solving interventions have been applied to adolescents and young adults with depression, previous evidence has shown variability in intervention approaches and findings [19]. In the present study, ECPST, which integrates emotion management into the problem-solving process, was applied to late adolescents with mild to moderate depression, with LINE used as a supportive tool to facilitate continued skills practice in a school setting.

Materials and Methods

Statistical Analysis

The assumptions of repeated-measures ANOVA were examined prior to analysis. Sphericity was assessed using Mauchly's test, and the Greenhouse–Geisser correction was applied when the assumption was violated. Effect sizes were reported using partial eta squared (partial η^2). Pairwise comparisons were performed using the Bonferroni adjustment. Statistical significance was set at $p < .05$.

Study design and setting

This quasi-experimental study used a two-group pretest–posttest design with one-month follow-up. The study was conducted at an upper-secondary school in the Mueang District of Rayong Province, Thailand, during the 2025 academic year.

Participants and Sample size

The sample size was determined using G*Power software, with an effect size of 0.50, a significance level (α) of .05, and the power of the test ($1-\beta$) of .80. The calculations indicated that a minimum of 16 participants per group was required. To account for potential sample attrition, the researcher increased the sample size by an additional 20%. Therefore, this study included 20 participants per group, totaling 40 participants.

Participants were selected from a registry of students with mild to moderate depression who met the eligibility criteria using simple random sampling without replacement. Participants were then matched based on gender, year of study, and grade point average (GPA) to enhance baseline

comparability between the two groups. Within each matched pair, participants were assigned to the experimental and control groups by drawing lots, with one participant allocated to each group, resulting in 20 participants in each group.

Research instruments

The instruments comprised a demographic questionnaire, the Thai version of the Center for Epidemiologic Studies Depression Scale, and the intervention program. The depression scale was used without modification and showed acceptable internal consistency in this study, with Cronbach alpha of .83. The intervention program was reviewed by five experts in psychiatric and mental health nursing, problem-solving therapy, child and adolescent psychiatry, clinical psychology, and information technology.

Human Subject Protection

All participants were informed about the study objectives and procedures, their voluntary participation, and their right to withdraw from the study before providing written informed consent. For participants under 18 years of age, informed consent was obtained from their parents. Students with severe depression were referred to the school's standard care system and responsible healthcare facilities.

Intervention

Participants in the experimental group received six sessions over a three-week period, with two sessions per week, lasting 60–90 minutes per session. The sessions included: (1) understanding depression and developing emotional self-awareness; (2) exploring previous coping experiences and problem-solving styles, their relationship with depression, and emotion management using the LINE application; (3) exploring problems, developing a positive problem orientation, enhancing motivation, and managing emotions; (4) developing rational problem-solving, decision-making, and planning skills; (5) evaluating the implementation of problem-solving plans, identifying problems and barriers, and adapting problem-solving strategies accordingly; and (6) exchanging problem-solving experiences, reviewing outcomes and barriers, reinforcing continued use of the acquired skills, and practicing emotion management through monitoring, homework, skill review, and continued practice.

The LINE application served as a supportive tool for reviewing program content and submitting assignments. Participants' adherence was monitored through activity logs, session reviews, and assignment submissions via the LINE Official Account (LINE OA). Sessions were scheduled at times convenient for participants in the experimental group to facilitate their participation.

The control group received routine school care, including individual counseling, education, supportive listening, and guidance according to individual needs, without participating in the experimental program.

Results

1. Participant characteristics.

Table 1. General Information of the Sample Groups.

The sample in this study consisted of 20 participants in each of the experimental and control groups. The majority of participants (85%) were female. The average age of the experimental group was 16.40 years (SD = .60), while the average age of the control group was 16.80 years (SD = .62). The average academic performance of the experimental and control groups was 3.00 (SD = .00) and 2.90 (SD = .31), respectively. The majority had no family history of depression. A comparison of the general information of both groups revealed no statistically significant differences at the .05 level, indicating that the two sample groups had similar basic characteristics, as shown in Table 1.

Table 1 Baseline Characteristics of the Participants in the Experimental and Control Groups

General Information	Experiment Group (n = 20)		Control Group (n = 20)		χ^2	*p-value*
	n	%	n	%		
Gender					.000	1.000[a]
Male	3	15.00	3	15.00		
Female	17	85.00	17	85.00		
Age (Years)					.350	.086[b]
16 Years	13	65.00	6	30.00		
17 Years	6	30.00	12	60.00		
18 Years	1	5.00	2	10.00		
	($\bar{x}$ =16.40, SD =.60)		($\bar{x}$ =16.80, SD = .62)			
Year of Study					4.800	.091[c]
Upper Secondary 10th grade	9	45.00	3	15.00		
Upper Secondary 11th grade	4	20.00	4	20.00		
Upper Secondary 12th grade	7	35.00	13	65.00		

Table 1 Baseline Characteristics of the Participants in the Experimental and Control Groups (Cont.)

General Information	Experiment Group (n = 20)		Control Group (n = 20)		χ^2	*p-value*
	n	%	n	%		
Grade Point Average (GPA)					.487	.244[a]
< 2.00	0	0.00	0	0.00		
2.01–3.00	0	0.00	2	10.00		
> 3.00	20	100	18	90.00		
Family's History of Depression						1.000[a]
Yes	2	10.00	1	7.50		
No	18	90.00	19	92.50		

Fisher's exact test [a], Cramer' V[b], Chi-Square t-test[c]

2. Effects of the program on depression

The mean depression score for the experimental group was 18.35 (SD = 1.73) at baseline, decreasing to 14.90 (SD = 3.28) immediately at post-intervention and further declining to 14.40 (SD = 3.93) at the one-month follow-up, indicating a continuous downward trend in depression scores. In contrast, the mean depression score for the control group was 18.40 (SD = 1.60) at baseline, 18.30 (SD = 3.51) immediately at post-intervention, and 17.45 (SD = 4.05) at the one-month follow-up, indicating only minimal changes over time, as shown in Table 2

Table 2 Means and standard deviation of depression scores for both groups across three phases

Intervention Phase	Experimental Group (n = 20)		Control Group (n = 20)	
	Mean	*SD*	*Mean*	*SD*
Pretest	18.35	1.73	18.40	1.60
Posttest	14.90	3.28	18.30	3.51
1 Month F/U	14.40	3.93	17.45	4.05

Comparison of mean depression scores between the experimental and control groups across the three time points was conducted using two-way repeated-measures ANOVA. The results indicated a statistically significant difference between groups, ($F(1, 38) = 7.374$, $p = .01$, partial η^2 =

.163, and a significant effect of time on depression scores, $F(1.519, 57.719) = 11.553$, $p < .001$, partial $\eta^2 = .233$. In addition, a significant group-by-time interaction was observed, $F(1.519, 57.719) = 6.115$, $p < .01$, partial $\eta^2 = .139$, indicating differences in the pattern of change in depression scores over time between the two groups. Details are presented in Table 3

Table 3 Comparison of Mean Depression Scores Between Experimental and Control Groups at Three Time Points

Sources of variance	*df*	*SS*	*MS*	*F*	*p*-value	Partial Eta Squared
Between Group						
Method	1	140.833	140.833	7.374	.01*	.163
Error	38	725.700	19.097			
Within Group						
Time	1.519	128.117	84.34	11.553	<.001***	.233
Method and Time	1.519	67.817	44.648	6.115	.008**	.139
Error	57.719	421.400	7.301			

p<.05*, *p*<.01**, *p*<.001***

Pairwise comparisons using the Bonferroni method in the experimental group showed that post-intervention depression scores (Mean = 14.90, SD = 3.28) and follow-up scores (Mean = 14.40, SD = 3.93) were significantly lower than at pretest (Mean = 18.35, SD = 1.73) ($p < .001$). However, there was no significant in difference depression scores between post-intervention and follow-up scores ($p > .05$). Details are shown in Table 4

Table 4 Pairwise Comparisons of Depression Mean Scores in the Experimental Group Across Three Time Points Using the Bonferroni Method

Intervention Phase	Mean (SD)	Intervention Phase		
		Pretest	Posttest	1 Month F/U
Pretest	18.35 (1.73)	-		
Posttest	14.90 (3.28)	-3.45*	-	
1 Month F/U	14.40 (3.93)	-3.95*	-.50	-

*p<.001

The analysis revealed a significant group × time interaction in depression scores, indicating that changes in depression scores over time differed significantly between the experimental and control groups, as illustrated in Figure 1.

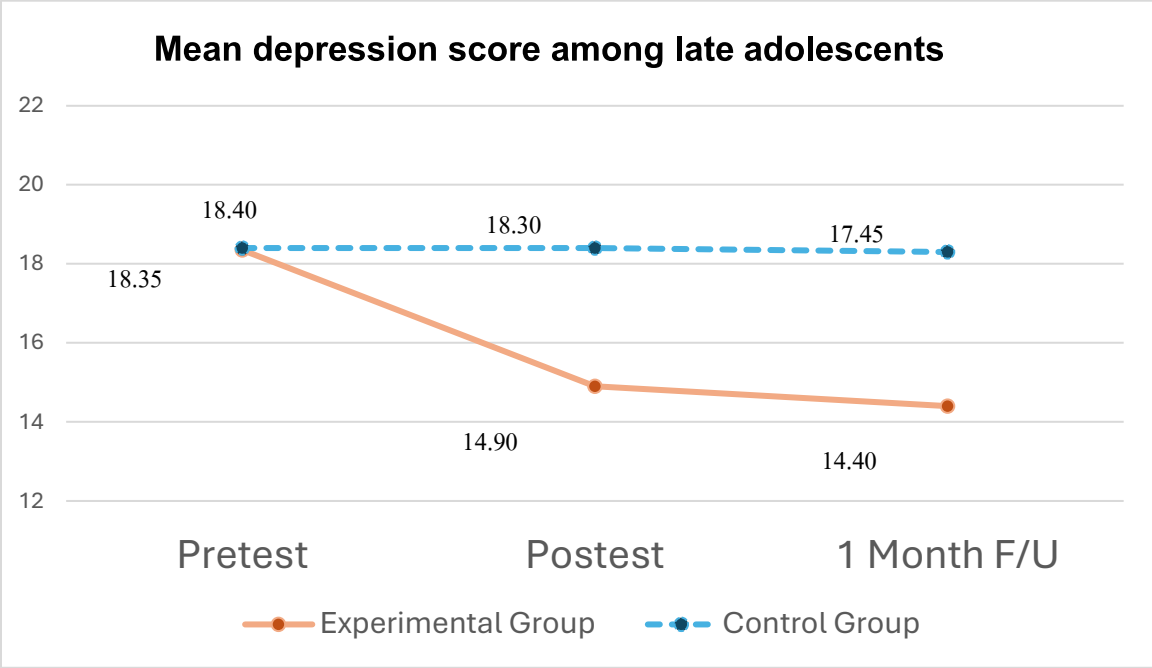


Figure 1 Interaction between intervention group and time on depression scores

Discussion

A Comparison of Depression Scores between Groups

The findings demonstrated significant differences in depression scores between the experimental and control groups, significant changes over time, and a significant group x time

interaction. The interaction indicates that the pattern of change in depression scores over time differed between the two groups. The experimental group showed a reduction in depression scores after the intervention that was maintained at the one-month follow-up, whereas the control group showed only minimal changes over the same period.

The significant reduction in depression scores in the experimental group may be explained by the use of the ECPST framework, which emphasizes the integration of emotion management with problem-solving processes.[17] Negative emotions or emotional overload may contribute to a negative problem orientation and interfere with effective problem solving [17]. Participation in the six structured activities helped these participants develop emotional awareness, emotion-management skills, a more positive problem orientation, and rational problem-solving skills. These skills may have enabled participants to manage negative emotions and cope more effectively with stressful problems, which may have contributed to the reduction in depression scores observed in the experimental group. These findings are consistent with previous evidence supporting the roles of emotion regulation and problem-solving approaches in improving depressive and related psychological symptoms among adolescents [20,21].

A Comparison of Depression Scores within the Experimental Group

Depression scores in the experimental group were significantly lower at both post-intervention and the one-month follow-up than at pre-intervention ($p < .001$), with no significant difference between post-intervention and follow-up scores ($p > .05$), indicating that the reduction in depression scores observed after the intervention was maintained during the one-month follow-up period. These findings are consistent with a previous study conducted with late adolescents, which found significantly lower mean depression scores after participation in a social problem-solving therapy program [16]. Previous research in other populations has also demonstrated the potential of emotion-centered problem-solving therapy for improving emotional symptoms [22]. Taken together, these findings support the integration of emotion management with problem-solving skills as a potential approach for reducing depressive symptoms in late adolescents.

The LINE application served as a supportive tool within the ECPST program, enabling participants to continuously review program content and practice emotion-management and rational problem-solving skills during and after group activities. This continued skills practice was consistent with the purpose of integrating LINE into the program and may have supported participants in maintaining the skills learned during the intervention. A previous study using a LINE Official Account

to monitor and support patients with depression also reported a reduction in the severity of depressive symptoms [23]. Previous evidence also suggests potential benefits of problem-solving interventions for reducing depressive symptoms among adolescents and young adults [19]. In the present study, depression scores at the one-month follow-up remained lower than baseline and did not differ significantly from post-intervention scores, indicating that the reduction in depression scores was maintained at the one-month follow-up. Therefore, future studies should consider a longer follow-up period of at least 3–6 months to evaluate the longer-term sustainability of the intervention effects.

Limitations

The study included a relatively small sample from a single school and had only a one-month follow-up period. These limitations may restrict the generalizability of the findings and the ability to determine the longer-term sustainability of the intervention effects.

Conclusion

The findings suggest that the ECPST program, with the LINE application as a supportive tool, helps reduce depression scores among late adolescents with mild to moderate depression in the school setting, with the reduction maintained at the one-month follow-up. These findings support the potential use of the program by school nurses and mental health professionals to promote emotion-management and problem-solving skills among late adolescents with similar characteristics and in similar school contexts.

Ethical Approval Statement

This study was approved by the Institutional Ethics Committee of the Institutional Review Board for the Protection of Human Subjects in Research, Burapha University Protocol Approval No. G-HS005/2568 (C2); Date of Approval: 21 April 2025.

Author Contributions

JD was responsible for the study design, development and implementation of the intervention program, data collection, data analysis, conclusions, and manuscript preparation and revision. PH and DV contributed to the study design, development of the intervention program, data analysis, conclusions, and manuscript preparation and revision. All authors read, reviewed, and approved the final version of the manuscript before its submission for publication.

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Conflicts of Interest

The authors declare no conflicts of interest.

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