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Exploring the impact of a transdiagnostic cognitive behavioural therapy-based intervention on a group of Malaysian adolescents with problematic drug use and emotional problems

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ABSTRACT

Introduction: Adolescents with problematic substance use frequently have anxiety and depression and tend to have "unhealthy" lifestyle such as having poor dietary patterns and physical inactivity. The overall aim of the present study was to explore the impact of a Transdiagnostic Cognitive Behavioral Therapy-based Intervention ("Super Skills for Life" – adolescent version; SSL-A) on emotional problems among adolescents with problematic substance use and to identify demographic factors which influence the intervention outcomes.
Method: A total of 108 adolescents (M = 16.30 years, SD = 1.6) with problematic substance use who showed high levels of anxiety and depression participated in this study. They completed a set of questionnaires to measure substance use, mental health problems, cognitive emotion regulation strategies, loneliness, and lifestyle and habits at pre- and post-intervention.
Results: The adolescents reported less emotional symptoms and more prosocial behavior after the intervention. These adolescents were also consumed less substance and used less maladaptive emotion regulation strategies after participating in SSL-A. Females compared to males showed more treatment gains (i.e., reduction in loneliness and improvement in psychological health and self-esteem) after the intervention.
Conclusion: This study provides empirical evidence for the utility of the SSL-A in reducing emotional problems and substance use among adolescents with problematic substance use.

1. Introduction

Substance experimentation is a frequent behavior in adolescence, with up to 81% had consumed illicit drugs world-wide (Swendsen et al., 2012). However, the prevalence of substance use varies across countries. In Malaysia, 1.7% adolescents have been reported to have consumed illicit drugs (Institute for Public Health, 2012); of these adolescents, 73.7% first used it before the age of 14 years. Furthermore, there has been an increase in the prevalence of substance use in recent years. From year 2012 to 2017, the use of alcohol, tobacco, and illicit drug among adolescents in Malaysia has increased from 8.9% to 10.2%, 11.5% to 13.8%, and 1.5% to 3.4%, respectively (Institute for Public Health, 2012, 2017). This increase was explained in terms of an increased availability, easy accessibility of alcohol and cigarette, and due to the lack of enforcement in checking under-age purchases of these two substances in Malaysia (Hammond et al., 2008).

Illicit drug use has been recognised as a global public health problem, contributing to 2% of the cause-specific disability-adjusted life-years for the 10–24-year-olds (Gore et al., 2011). The use of substances (e.g., alcohol and illicit drugs) not only increase the risk of developing chronic illness during adulthood, but is often linked to motor vehicle accidences, violence and delinquent behavior, and unprotected sex (Dir et al., 2018). Studies have also reported substance use to be associated with poor academic performance (Bajwa et al., 2013).

Adolescents with problematic substance use or substance use disorders (SUD) frequently have comorbid mental health problems such as anxiety and depression. The prevalence of anxiety and depression among adolescents with SUD has been reported to range from 7% to 40% and 11% to 32%, respectively (Hutchinson, Teague, Champion, Essau, & Newton, 2020; Leung, Hall, & Degenhardt, 2020). According to

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some authors this association may be bidirectional, in that substances may be used as "self-medication" by adolescents with mental health problems in order to alleviate feelings of anxiety and depression. By contrast, adolescents with problematic substance use tend to have increased risk of emotional problems.

Recent studies have reported that adolescents with mental health problems, including those with SUD, tend to have "unhealthy" lifestyle such as having poor dietary patterns, having sleep problems, and physical inactivity (Hirshkowitz et al., 2015; Khazaeian, Kariman, Ebadi, & Nasiri, 2018; Ohayon et al., 2017). Specifically, unhealthy diet such as high intake of snacks and animal food (e.g., pork, beef, chicken, other meat) were associated with emotional problems (Oellingrath, Svendsen, & Hestetun, 2014), whileas traditional Chinese diet (with high intakes of cereals, vegetables, fruits, aquatic products, beans, and nuts) was associated with good emotional health (Weng et al., 2012). Furthermore, healthy dietary and nutrition patterns have been shown to improve mental health (Khalid, Williams, & Reynolds, 2016). Moreover, between 10% and 20% of the adolescents are estimated to experience sleep difficulties (Thumann et al., 2019) and that these sleep problems are common among young people with anxiety and depression (Bauducco, Flink, Jansson-Fröjmark, & Linton, 2016; Ojio, Nishida, Shimodera, Togo, & Sasaki, 2016). Numerous recent studies have shown the link between physical activity and mental well-being (Asare & Danquah, 2015; Ho, Louie, Chow, Wong, & Ip, 2015; Wheatley, Wassenaar, Salvan, Beale, Nicols, Dawes, et al., 2020). Furthermore, a recent systematic review and meta-analysis by Andermo et al. (2020) have shown school-related physical activity interventions to be associated with improvement of young people's mental health.

Given the negative impact of problematic substance use among adolescents, much effort has been devoted to developing intervention programmes for this condition. Of all the interventions, Cognitive behavioral therapy (CBT) approach has the highest level of empirical support (Carroll & Kiluk, 2017). CBT targeting SUD have also been reported to reduce the severity of depressive symptoms among adolescents with comorbid depression (Nunes & Levin, 2004). However, most studies had indicated a modest effect size suggesting a need for improvement (Carroll & Kiluk, 2017).

Despite the above findings, hardly any studies have examined the impact of psychological intervention programme which integrates elements of CBT and "healthy lifestyles" in reducing anxiety and depression among adolescents with problematic drug use. To make up this gap, the present study implemented a transdiagnostic CBT-based intervention ("Super Skills for Life" – adolescent version; SSL-A, Essau & Ollendick, 2016) that has been developed for adolescents with emotional problems.

The transdiagnostic approach is based on the findings on the high comorbidity between anxiety and depression (Cummings, Caporino, & Kendall, 2014), common core risk factors of emotional problems, and overlapping emotional, cognitive, and behavioral processes within emotional problems (Ehrenreich-May & Bilek, 2012). Most evidence-based treatment protocols have been developed for single disorder, although most of them contains common clinical practices such as problem solving (Chorpita & Daleiden, 2009); as such treatment protocol for a single disorder might not be the most cost-effective and time efficient. Thus, in a transdiagnostic approach, empirically supported practices are consolidated in the treatment protocols which might gain robustness as those common practices are aimed to target core underlying mechanisms of emotional problems (Chu, Chen, Mele, Temkin, & Xue, 2017).

In using a transdiagnostic framework, SSL-A targets common core risk factors of emotional problems such as low self-esteem, lack social skills. Furthermore, SSL-A is based on the following core principles: (1) it uses principles of CBT to help adolescents develop skills to cope with anxiety-provoking situations; (2) it uses the principles of behavioural activation by having adolescents increase their activity levels and participate in positive and rewarding activities; (3) it teaches adolescents basic skills to use during social interactions; and finally (4) it helps to promote healthy life style (i.e., regular physical activity, reframe from smoking and limit alcohol consumption, eating healthy food). See Section 2.3 for more description of SSL-A.

Empirical studies have provided further support in showing the benefit of participating in SSL, including reducing emotional problems (Essau et al., 2014; Essau, Sasagawa, Jones, Fernandes, & Ollendick, 2019; Fernández-Martínez, Morales, Espada, Essau, & Orgilés, 2019), recovering faster from a stressful task as shown through cardiac recovery indexes (de la Torre-Luque, Fiol-Veny, Essau, Balle, & Bornas, 2020), improving social and communication skills (Fernández-Martínez, Morales, Espada, & Orgilés, 2020; Melero, Morales, Espada, & Orgilés, 2021; Melero, Morales, Espada, Méndez, & Orgilés, 2021), and coping with the covid-19 lockdown (Orgilés, Espada, & Morales, 2020. SSL has been implemented in a wide range of settings such as in residential care institutions (Ramdhonee-Dowlot, Balloo, & Essau, 2021) and a Pupil Referral Unit for adolescents who have been excluded from mainstream schools (Allan, Uzun, & Essau, 2021).

As most of these studies were based on adolescents with emotional problems, the impact of SSL-A among adolescents with problematic substance use and emotional problems is lacking. Thus, the aims of the present study were (a) To examine whether there are any changes in emotional problems among adolescents with problematic substance use after participating in SSL-A. (b) To identify whether demographic variables such as gender and age influence treatment outcomes.

2. Method

This study was part of a larger study conducted by the deputy Ministry of Youth and Sports, Malaysia under the Pakatan Harapan government. The study was conducted in accordance with the Declaration of Helsinki; the study protocol were reviewed and approved by the Ministry of Education in Malaysia. All parents were provided with a letter of invitation explaining the study together with an informed consent form to be completed and returned by their parents to the project team. Parents were informed that their children would be taught specific skills that they could use to better cope with challenging situations. Adolescents' participation was voluntary study.

The present study was conducted between September and November 2019. The adolescents completed the same questionnaires one week before and one week after participating in SSL-A within school hours. The six-month follow-up assessment was planned to take place in April-May 2020, however, due to school closure in order to contain the spread of COVID-19, this assessment did not take place.

2.1. Participants

A total of 108 adolescents participated in this study. Seventy-four (68.5%) were boys and 34 (31.5%) were girls. Their age ranged from 13 to 19 years ($M = 16.30$ years, $SD = 1.6$); this age group corresponds to peak age of onset and prevalence of mental health and substance use problems (Kessler et al., 2005). Almost half of the participants (48.1%) live with both of their parents.

The participants were recruited from 8 juvenile home and reform schools in Malaysia. In Malaysia, when adolescents are arrested by police for a crime, they will be presented in court. Parents may post Bail, however, if this is not the case, the adolescents will be housed in a juvenile home. Adolescents will be in remand until they admit guilty in court. The magistrate will judge whether these adolescents should be released on parole or be sent to a reform school for rehabilitation through community service projects and learning vocational and technical skills.

These adolescents were being placed in these institutions due to problematic drug consumption and/or to their involvement in drug-related activities. They were referred by their teachers because they showed high levels of anxiety and depression. Almost all the adolescents (98%) who were referred to participate in this study received a consent

from their parent to take part in the study. Only adolescents with a parental written consent participated in this study.

2.2. Measures

2.2.1. Demographic questionnaire

Demographic questionnaire was used to measure participant's socio-demographic information such as their gender, living arrangement, and age.

2.2.2. The Strengths and Difficulties Questionnaire

The Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) was used to measure the adolescent's general difficulties and positive attributes. It contains 25 items which was rated on a 3-point scale, ranging from 0 (not true) to 2 (certainly true). These items can be divided into five subscales: emotional symptoms, conduct problems, hyperactivity, peer problems, and prosocial behaviour. The total difficulties scores were obtained by adding all the subscales except for the pro-social behaviour subscale, with higher scores indicated greater difficulties. The Cronbach's alpha for the total scale in the present study was 0.67 at pre-test and 0.75 at post-test.

2.2.3. The cognitive emotion regulation questionnaire

The cognitive emotion regulation questionnaire (CERQ; Garnefski, Koopman, Kraaij, & ten Cate, 2009) was used to measure cognitive emotion regulation strategies that the adolescents use in response to their experience of threatening or stressful life events. The CERQ consists of 18 items, which can be rated on a 5-point scale, ranging from 1 (almost never) to 5 (almost always), with higher scores indicating more use of emotion regulation strategy. Four of the subscales represent maladaptive emotion regulation strategies: self-blame, rumination, catastrophising and other blame. Five subscales represent adaptive emotion regulation strategies: acceptance, positive refocusing, planning, positive reappraisal and putting into perspective. In the present study, the Cronbach's alpha for the total scale was 0.84 at pre-test and 0.83 at post-test.

2.2.4. Behavioral Activation for Depression Scale – short form

Behavioral Activation for Depression Scale – short form (BADS-SF; (Manos, Kanter, & Luo, 2011) was used to measure behavioral aspects of depression such as activation, rumination or avoidance. It contains 9 items which can be rated on a 7-point scale, ranging from 0 (Not at all) to 6 (Completely). In the present study, the Cronbach's alpha for the total scale was 0.76 at pre-test and 0.77 at post-test.

2.2.5. Loneliness Scale

Loneliness Scale (Hughes, Waite, Hawkley, & Cacioppo, 2004) was used to measure individuals' perceptions of social isolation. It contains 8 items which can be rated on a 4-point scale, ranging from 1 (Never) to 4 (Often). In the present study, the coefficient alpha for the Loneliness Scale was 0.53 at pre-test and 0.69 at post-test.

2.2.6. Lifestyle and Habits Questionnaire-brief version

Lifestyle and Habits Questionnaire-brief version (LHQ-B; Dinzeo, Thayasivam, & Sledjeski, 2014) was used to measure various dimensions of health including physical health and exercise, substance use (alcohol/drug and tobacco), nutritional control, sense of purpose, and psychological health. It contains 25 items, and each item was rated on a 5-point scale from 1 "strongly disagree" to 5 "strongly agree". In the present study, the Cronbach's alpha for the total scale was 0.86 at pre-test and 0.87 at post-test.

2.2.7. Translation of instruments

The English version of the questionnaires were adapted and translated following the guidelines for the successful translation of instruments (Brislin, 1970). One bilingual translator who was also a native speaker blindly translated the questionnaires from the original language (English) to Bahasa Malaysia, and another bilingual individual translated them back to the original language. Differences in the original and the back-translated versions were discussed and resolved by joint agreement of both translators.

2.3. The Intervention: super skills of life – adolescent version (SSL-A)

The SSL-A consists of eight sessions, which are implemented once a week for the duration of eight weeks. The content and activities covered in SSL-A are listed in Table 1. The program teaches adolescents the following skills: education about emotions and feelings, cognitive reappraisal, problem-solving, behaviour activation, relaxation techniques, self-monitoring, and social competence. These skills were taught through various formats, including small group and individual exercises, role plays, activities, and games. One session covers healthy lifestyles, focusing on sleep hygiene, healthy diet, and regular physical activity.

2.3.1. Implementation of the SSL-A

The delivery of the SSL-A was conducted by the officers working at the deputy Ministry of Youth and Sports, and school counsellors after receiving an intensive one-day workshop by one of the co-authors (CAE). The workshop covered topics related to emotional problems and their risk factors, and the principles of prevention and on how to facilitate group intervention. All the facilitators were given a leader's manual which gives step-by-step instructions on how to implement each session of SSL-A. The instructions clearly outline the main aims and strategies to be used for each session, the desired outcomes, and the activities to be used in meeting these outcomes.

All adolescents received a copy of the SSL workbook. Each session consists of 45 min with on average eight adolescents per treatment group. Home activities were given at the end of each session to enable the continued practice of the skills learnt and participants were needed to return completed home tasks in the following sessions. These home activities were reviewed and discussed at the beginning of the subsequent session.

2.4. Statistical analyses

All statistical analyses were performed using IBM SPSS version 20, apart from the polyserial correlation, which was calculated using Mplus version 8. A series of Kolmogorov-Smirnov tests were applied to determine whether changes in pre- to post-treatment variables had a normal

Table 1
Contents of the SSL-A.

Session	Aims/Activities
Session 1	– Introduce the participants to the Super Skills for Life (Adolescent version) (SSL-A). – Discuss behaviours that are related to a "healthy" lifestyle (i.e., eating healthy food, regular physical activities, enough sleep).
Session 2	– Introduce the participants with the concept of self-esteem and to discuss activities that could help to enhance self-esteem. – Discuss various small steps that are needed to develop a particular skill.
Session 3	– Introduce the participants to the concept of feelings and thoughts.
Session 4	– Introduce the concept of the link between thoughts, feelings, and behaviour.
Session 5	– Learn about the impact of stress on our body and feelings. – Teach the participants specific relaxation strategies to cope with stress and anxiety.
Session 6	– Discuss the importance of having a good relationship. – Learn specific skills that are needed to get along with other people.
Session 7	– Learn to use problem-solving steps in dealing with social problem.
Session 8	– Introduce the importance of having a sense of future.

distribution. When the distribution was nonnormal, Wilcoxon signed-rank test was used to examine whether there were changes in outcome measure scores. Subsequently, correlational analysis between demographic variables and differences in pre- to post-outcome scores was performed. Repeated measures ANOVA using the Bonferroni method was applied where the correlation was significant. Upon this procedure, the effects of demographic variables on the outcome measures were examined.

3. Results

Changes from pre-treatment to post-treatment for all primary and secondary outcome measures were examined. Kolmogorov-Smirnov tests showed that the distribution for all primary outcome measures were nonnormal; thus, Wilcoxon signed-rank test was utilized (Table 2). For the primary outcome measures, emotional symptoms ($z = -2.22$, $p < .05$) of the SDQ reached significance level, and prosocial behavior ($z = 1.95$, $p < .10$) and total SDQ score ($z = -1.68$, $p < .10$) was marginally significant. It was demonstrated that the participants had less emotional symptoms and tended to show more prosocial behavior, as well as improved total SDQ score, after the SSL-A was delivered.

Kolmogorov-Smirnov tests showed that the distribution for all secondary outcome measures were nonnormal as well, and thus Wilcoxon signed-rank test was used. Substance use subscale of the LHQ-B ($z = 2.76$, $p < .01$) and maladaptive emotion regulation strategies of the CERQ ($z = -2.53$, $p < .05$) was significant (Table 3). These findings suggested that adolescents engaged in less substance use and used less maladaptive emotion regulation strategies after participating in SSL-A.

Product-moment and polyserial correlation between the demographic variables (gender, living arrangement, and age) and changes in T1 to T2 primary and secondary outcome variables (i.e., T1 total SDQ score – T2 total SDQ score) were calculated to determine whether the demographic variables had an effect on treatment outcomes. A series of repeated measures ANOVA was conducted where the correlation was significant. The demographic variable that had the strongest impact on outcome measures was gender (Table 4). Specifically, the SSL-A yielded better results in general for females compared to males. There was a significant interaction between gender and time (pre-treatment/post-treatment) for total SDQ difficulties scores ($F(1, 102) = 4.49$, $p < .05$), as well as on the conduct problems ($F(1, 106) = 5.87$, $p < .05$), and peer problems ($F(1, 106) = 4.80$, $p < .05$). Post hoc analyses by Bonferroni method showed a decrease in total SDQ difficulties score, conduct problems and peer problems in the female sample; no significant changes were found for the male data. Similarly, a significant interaction between gender and time were shown for loneliness ($F(1, 106) = 14.49$, $p < .001$), psychological health ($F(1, 106) = 6.00$, $p < .05$), and self-esteem ($F(1, 102) = 6.12$, $p < .05$). All three variables improved after treatment in the female sample. Changes in loneliness and psychological health scores did not reach significance in the male sample, and self-esteem score receded. The results are summarized in Table 4.

There was no significant interaction between age and time for any of the primary and secondary outcome variables. Significant main effect of age was found for the prosocial behavior subscale of SDQ ($F(2, 105) = 7.20$, $p < .01$), and the main effect of time was marginally significant ($F(2, 105) = 3.59$, $p < .10$). Multiple comparison using Bonferroni method showed that age group 13–15 scored lower than age groups 16–17 and 18–19. While the SSL was beneficial in augmenting prosocial skills in adolescents of all ages, the older children had better skills than younger ones. The main effect of age was also significant for the exercise subscale of LHQ-B ($F(2, 105) = 3.31$, $p < .05$). Post hoc analysis showed that age group 13–15 scored significantly lower than age group 18–19 years. The main effect of time was not significant.

4. Discussion

To our knowledge this is amongst the first study to have used a transdiagnostic CBT-based protocol among adolescents with problematic substance use and who had a high level of anxiety and depression. The participants have been referred by their teachers to participate in our study as they displayed a high level of anxiety and depression. The unique feature of this study is that it was conducted in the natural environment (i.e., within the school setting) and delivered by non-researcher staff (i.e., officers of the deputy Ministry of Youth and Sports, and school counsellors).

The findings could be summarised as follows: First, in agreement with previous studies, emotional symptoms significantly reduced from pre- to post-test assessments (Essau et al., 2014; Essau, Sasagawa, Jones, Fernandes, & Ollendick, 2019; Fernández-Martínez, Orgiles, Morales, Espada, & Essau, 2020; Orgilés, Melero, Fernández-Martínez, Espada, & Morales, 2020; Ramdhonee-Dowlot, Balloo, & Essau, 2021). However, unlike some previous studies (Fernández-Martínez et al., 2020), no significant reduction was found on behavioral problems. The reason for this inconsistent finding is unclear although it could be related to the setting in which the adolescents were recruited. The adolescents in the present study were recruited from juvenile hostels and reform schools because of their problematic drug use therefore their conduct problems could have been more complex and severe that adolescents from mainstream schools.

Second, our findings showed significant reduction in maladaptive emotion regulation strategies. This finding was in line with the result reported in a recent study by Ramdhonee-Dowlot, Balloo, & Essau, 2021 in a group of children from residential homes in Mauritius. In that study (Ramdhonee-Dowlot et al., 2021) use of maladaptive ER strategies of self-blame, rumination, catastrophising and other-blame was significantly decreased at both post-intervention and follow-up. These findings support the view that adaptive cognitive emotion regulation strategies could be important markers of resilience (Mak, Ng, & Wong, 2011).

CBT-based intervention is one of the most commonly used psychosocial interventions for SUD, with studies showing its efficacy across drug types (Magill et al., 2019). Our study provided further support in the benefit of using CBT-based intervention in reducing substance use in adolescents. SSL-A was developed for adolescents with anxiety and depression, and not specifically for those with SUD. However, SSL-A does contain similar components of CBT that has been developed specifically for SUD such as teaching adolescents affect regulation and social skills, increasing activities that help to increase positive reinforcements, and identification of intrapersonal and interpersonal triggers for specific behavior (e.g., substance use) (Magill et al., 2019).

Table 2
Impact of the intervention of the primary outcome measures.

	Pre-treatment		Post-treatment		Kolmogorov-Smirnov test	Wilcoxon signed-rank test	Effect size (R)
	Mean (SD)	Median	Mean (SD)	Median			
Emotional symptoms	4.22 (2.26)	4.50	3.69 (2.59)	3.00	0.15***	−2.22*	0.21
Conduct problems	4.27 (1.69)	5.00	4.06 (1.91)	4.00	0.15***	−1.06	0.10
Hyperactivity	4.39 (1.74)	5.00	4.38 (1.76)	5.00	0.23***	−0.25	0.02
Peer problems	4.09 (1.57)	4.00	4.07 (1.81)	4.00	0.18***	−0.62	0.06
Prosocial	6.49 (1.98)	6.00	6.89 (1.91)	7.00	0.25***	1.95†	0.19
Total SDQ score	17.12 (5.28)	18.00	16.22 (5.85)	16.00	0.13***	−1.68†	0.16

Table 3
Impact of the intervention of the secondary outcome measures.

	Pre-treatment		Post-treatment		Kolmogorov-Smirnov test	Wilcoxon signed-rank test	Effect size (R)
	Mean (SD)	Median	Mean (SD)	Median			
Loneliness	16.55 (3.43)	17.00	16.34 (4.04)	17.00	0.16***	-0.30	0.03
Substance use (e.g., avoid drinking, taking drug)+	15.98 (4.77)	16.00	17.46 (4.61)	18.00	0.19***	2.76**	0.27
Cognitive emotional regulation strategies							
Adaptive	34.72 (5.69)	34.00	34.42 (6.22)	35.00	0.15***	0.19	0.02
Maladaptive	27.11 (4.37)	27.00	25.93 (4.88)	26.00	0.13***	−2.53*	0.24
Purpose of life	11.94 (2.14)	12.00	11.87 (2.39)	12.00	0.24***	0.10	0.01
Psychological health	15.59 (2.55)	16.00	15.60 (2.93)	16.00	0.18***	1.03	0.10
Behavioral Activation for Depression Scale							
Activation	22.85 (5.89)	23.00	23.31 (5.83)	23.00	0.10*	0.71	0.07
Avoidance	9.98 (4.03)	10.00	9.51 (3.36)	9.00	0.14***	−1.41	0.14
Exercise	22.41 (3.81)	22.00	22.46 (3.95)	22.00	0.18***	0.65	0.06

Note: +Higher number indicate lower use of substance(s).

Table 4
Repeated measures ANOVA with significant interaction (Gender).

	Female		Male		Bonferroni Comparison
	Pre-Mean (SD)	Post-treatment Mean (SD)	Pre-Mean (SD)	Post-treatment Mean (SD)	
Primary Outcome Measures					
Conduct problems	4.59 (1.6)	3.71 (1.5)	4.12 (1.7)	4.23 (2.1)	Female: Pre > Post ($p < .05$)
Peer problems	4.50 (1.5)	3.91 (1.5)	3.91 (1.6)	4.15 (1.9)	Female: Pre > Post ($p < .10$)
Total SDQ score	18.47 (5.0)	15.74 (4.6)	16.46 (5.3)	16.46 (6.5)	Female: Pre > Post ($p < .05$)
Secondary Outcome Measures					
Loneliness	17.41 (3.5)	15.06 (4.0)	16.15 (3.4)	16.93 (4.0)	Female: Pre > Post ($p < .01$)
Psychological health	14.79 (2.7)	15.94 (2.4)	15.96 (2.4)	15.45 (3.1)	Female: Pre < Post ($p < .05$)
Self-Esteem	9.21 (1.4)	9.65 (1.2)	9.68 (1.3)	9.39 (1.3)	Female: Pre < Post ($p < .10$) Male: Pre > Post ($p < .10$)

Future studies are needed to identify which components of SSL-A are associated with changes in our intervention outcomes.

Fourth, girls benefitted significantly from SSL-A in that there was a significant reduction in the total difficulties scores on the SDQ as well as on the conduct and peer problems subscales; these findings were not found in boys. The effect of gender in emotional problems in intervention studies has been inconsistent in some previous studies. For example, studies that used the FRIENDS program reported that both girls and boys uniformly benefited from the intervention (Essau, Conradt, Sasagawa, & Ollendick, 2012; Lowry-Webster, Barrett, & Lock, 2003). The reason for this inconsistent finding was unclear although it could be attributed to the fact that in the present study there were more boys than girls, whereas in the two previous studies (Essau et al., 2012: Lowry-Webster et al., 2003), there were more girls than boys. It is possible that girl's improvement in difficulties scores could be related to the reduction of loneliness and an improvement in self-esteem following the intervention, findings found in girls but not in boys.

In interpreting our findings, the study's methodological limitations need to be taken into account. The first limitation was related to the small sample size. Furthermore, due to school closure the planned six-month follow-up assessment did not take place so that it is unclear if the positive outcome was maintained. Another limitation was that the study did not use any structured diagnostic interviews because it was implemented in routine school setting with limited human resources. However, the SDQ was used to measure emotional and behavioral problems in adolescents which has proven to be both valid and reliable in distinguishing adolescents with and without any mental health problems (Essau et al., 2012). The third limitation was that the present study used an open clinical trial design, without any control group. Therefore, the potential problem related to the internal validity of the programme could be the passage of time and factors (e.g., being in a group of adolescents) which might be unrelated to the programme. These limitations notwithstanding, our findings showed the utility of the SSL-A in reducing anxiety and depressive symptoms and substance use among adolescents with problematic substance use. Given public health implications of anxiety, depression and problematic substance use among adolescents, future studies with long-term follow-up are needed to determine the long-term effect of SSL on mental health problems and exposure to substance use as these conditions tend to increase into early adulthood. Longer-term follow-up should shed light on factors which might mediate the treatment outcome.

CRediT authorship contribution statement

SZ: Project management, Data curation, Writing - original draft. SS: Undertook the analyses and interpreted the results, review & editing. CAE: Conceptualization, Critique the output for important intellectual content, provided theoretical support. CAE, a co-developer of Super Skills for Life, was not involved with data collection, cleaning, and analyses. These tasks were conducted independent of CAE.

Declaration of Competing Interest

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

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