Routledge
Taylor & Francis Group

The Journal Of Positive Psychology

Cultivating Character strength: Evidence from the “24 Flavors of Positive Thinking” School-Based Program in Hong Kong Adolescents: A Quasi-Experimental Study

Submission ID	255559473
Article Type	Research Article
Keywords	positive psychology intervention, Quasi-experimental design, adolescents, Character strength
Authors	Junhao Chen, F. H. C. Kwok, Amy Chan, Erin Li, X. Y. Wei, Q. Q. Tian, Amy Cheung

Cultivating Character strength: Evidence from the "24 Flavors of Positive Thinking" School-Based Program in Hong Kong Adolescents: A Quasi-Experimental Study

Jun Hao Chen[1](First author), Kwok, F. H. C[3](Co-first Author), Amy Chan[4]., H.Y. Erin Li[2]., X.Y. Wei[2], Q.Q. Tian[2], H.N Cheung[2*](Corresponding Author)
[1]Department of Social and Behavioural Sciences, College of Liberal Arts and Social Sciences, City University of Hong Kong, Hong Kong SAR; [2]Department of Social Work and Social Administration, The University of Hong Kong, Hong Kong; [3]Division of Social Science, The Hong Kong University of Science and Technology, Hong Kong; [4]Child Development Initiative Alliance, Hong Kong

Corresponding Author Note
*Correspondence of this article should be addressed to Amy Cheung Ho Nam
Address: The University of Hong Kong, Department of Social Work and Social Administration
E-mail address: amy.hn.cheung@hku.hk

Declaration of Conflicting Interests
The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
This work was funded by the Child Development Initiative Alliance (CDIA), Hong Kong.

Ethical Approval
Ethical approval was obtained from the University of Hong Kong ethics committee.

Data Availability
The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to the containing information that could compromise the privacy of research participants.

Informed Consent
Informed consent was obtained from all study participants.

Transparency and Openness Statement
Materials (print-out of an electronic survey, questions, and questionnaire items) used in the survey are not openly available. These can be obtained from the corresponding author upon request.

Cultivating Character strength: Evidence from the "24 Flavors of Positive Thinking" School-Based Program in Hong Kong Adolescents: A Quasi-Experimental Study

Abstract

Background: Positive thinking and character strengths are critical protective factors for adolescent mental health, yet scalable interventions to foster these attributes in diverse cultural contexts remain limited. This study evaluated the efficacy of the novel "24 Flavors of Positive Thinking (24F)" intervention, a multifaceted program incorporating inspirational CEO stories and positive cinema, to enhance positive thinking and character strengths among Hong Kong adolescents.

Methods: In a large-scale quasi-experimental design, 1,344 adolescents were assigned to one of five conditions: low-dose CEO stories (one session), high-dose CEO stories (two sessions), low-dose positive cinema (one session), high-dose positive cinema (two sessions), or a no-intervention control. Positive thinking was assessed at baseline and at the last available post-intervention timepoint (with an additional intermediate assessment for high-dose groups). Character strengths were assessed by self-identification of three strongest/weakest VIA strengths, and satisfaction was assessed in intervention arms only. Data were analysed using cluster-aware mixed-effects models, including mixed-effects ANCOVA adjusting for baseline positive thinking and, among intervention arms, factorial tests of activity format (CEO vs cinema), dosage (two vs one session), and their interaction; repeated-measures mixed models examined change over time.

Results: Baseline positive thinking differed across conditions ($p = .006$; ICC $\approx .03$). After adjustment for baseline and clustering, condition significantly predicted last-post positive thinking ($p < .001$), with all intervention arms exceeding the control. In factorial analyses among intervention arms, dosage showed a robust main effect ($p < .001$), whereas activity format was not significant ($p = .277$) and the activity x dosage interaction was not significant ($p = .073$). Repeated-measures models indicated that positive thinking increased over time in high-dose conditions, while remaining stable or decreasing in lower-dose/control conditions. Satisfaction was higher in high-dose conditions ($p < .001$) with no activity effect. For six focal strengths, only bravery showed a reliable differential increase (high-dose CEO vs low-dose CEO) after FDR correction; other strengths showed no robust between-condition differences.

Conclusions: The 24F intervention effectively boosted positive thinking and character strengths in adolescents, with dosage effects outweighing activity type, highlighting its flexibility and scalability. These findings offer robust evidence for culturally tailored positive psychology programs in promoting youth resilience and mental well-being, with implications for public health strategies in urban Asian settings.

Keywords: positive psychology intervention; Quasi-experimental design; adolescents; school based; Character strength

1. Introduction

Hong Kong adolescents are facing an increasingly alarming public health crisis. Despite being high achievers academically, their resilience and psychological well-being fall far below global averages (OECD, 2023). Over the years, Hong Kong adolescents have consistently reported higher levels of depressive symptoms and lower levels of mental well-being than their peers in other regions (Yuen et al., 2019). Recent cross-sectional findings indicate that more than one-third of adolescents experience depressive symptoms and anxiety, and nearly half report high levels of stress (BOKSS, 2024; Fang, 2023; Yu & Du, 2022). These difficulties are associated with risky behaviours, developmental problems, lower quality of life, crime, and suicide (Shek & Wong, 2025; Tsui & Cheng, 2021; Yu & Du, 2022), underscoring the urgent need for effective school-based mental health promotion.

Hong Kong's education system is, in principle, receptive to positive psychology and school-based prevention. Positive psychology initiatives have been shown to enhance academic outcomes and teacher well-being (Chung, 2018), and the Education Bureau has explicitly called for universal and early supports (e.g., the Whole School Approach and the Three Tier School based Emergency Mechanism), emphasizing prevention and early identification rather than treatment only after onset (Government of the Hong Kong Special Administrative Region, 2025). Cognitive- and behavioural-based programmes, including classroom-adapted CBT, are available and remain first-line, evidence-based approaches for youth anxiety and depression worldwide (Compton et al., 2004; Kendall & Peterman, 2015; Low & Lee, 2024; Orchard et al., 2020; Wong et al., 2018). Territory-wide strengths-oriented initiatives such as Project P.A.T.H.S. have demonstrated the feasibility of large-scale school-wide programmes and have yielded benefits across psychosocial outcomes in junior secondary schools (Shek and Sun et al., 2013).

1.1. Service and Research Gaps in Current School-Based Initiatives

Despite this apparent infrastructure, major *service* and *research* gaps remain. At the service level, existing initiatives rely heavily on indicated or selective interventions and on adolescents' willingness to seek help. However, a representative youth epidemiological study (2019–2022) showed that only 16.7% and 28.1% of adolescents with mental health needs sought help from mental health or other helping professionals, respectively (Wong et al., 2023). Half of secondary students experiencing mental distress reported that they would avoid or delay seeking help (YMCA, 2024), citing cost, preference for informal support, scheduling conflicts, doubts about efficacy, and stigma as key barriers (Wong et al., 2023). As a result, a substantial proportion of distressed adolescents are never reached by existing services, highlighting a service gap in universal, low-stigma, classroom-embedded mental health promotion.

A second service limitation is feasibility and scalability. Many school-based CBT and strengths-related programmes are resource-intensive, multi-session, and run in a course-like format that competes with academic demands. This model is difficult to sustain in a system that places heavy emphasis on academic excellence and already exposes adolescents to high academic stress and workload (Cho & Chan, 2020; Lai et al., 2022). Even successful programmes such as Project P.A.T.H.S. require considerable time, training, and coordination (Shek and Sun et al., 2013). Schools therefore face a practical gap: scalable, brief interventions that can be integrated into timetables without adding substantial burden on students or staff.

At the research level, the local evidence base for brief, universal, culturally grounded strength-based interventions is extremely limited. Existing evaluations of strength-oriented programmes for Hong Kong adolescents have mostly used lesson-based formats that directly teach positive skills. For example, Kwok et al. (2022) developed a seven-session Multiple Component Positive Psychology Intervention to improve gratitude and emotional intelligence among adolescents with anxiety symptoms; Zhou et al. (2015) implemented a two-session programme targeting gratitude and hope; and the revised Positively Kellett program used weekly lessons over a full academic year to enhance emotional literacy, resilience, and life effectiveness (Blaine, 2024). While Kwok et al. (2022) and Zhou et al. (2015) reported gains in targeted traits, Blaine (2024) observed decreases in intended outcomes,

suggesting that strengths-based content does not automatically translate into benefits and that format and context matter. Few studies have examined brief, low-dose, strengths-based interventions embedded in routine school schedules, and virtually none have systematically compared different delivery modalities or dosages in real-world Hong Kong school settings.

These limitations together define a dual gap: (a) a *service gap* in reaching adolescents who will not seek help and in providing feasible, low-burden programmes, and (b) a *research gap* in understanding whether brief, culturally tailored, strengths-based interventions can effectively promote mental health when embedded in everyday school life.

1.2. Strength-Based Targets: Character Strengths and Positive Thinking

A strength-based approach offers a promising way to address these gaps. Strength-based interventions aim to identify and cultivate individuals' strengths, skills, and talents, using these as the primary levers to address challenges and deficits (Flückiger et al., 2023). This contrasts with traditional CBT, which focuses on dysfunctions and vulnerabilities in cognition, behaviour, or emotion (Benjamin et al., 2011). In school settings, multicomponent positive psychology interventions (PPIs) have shown small but robust improvements in subjective and psychological well-being and reductions in depressive symptoms that endure over time (Tejada-Gallardo et al., 2020). Strength-based approaches can also be implemented in mult-session and single-session formats, with evidence that they improve well-being and foster resilience and confidence (Bu & Duan, 2018; Quinlan et al., 2011; Schleider et al., 2020), making them particularly attractive in contexts with constrained resources.

Within strength-based frameworks, two targets stand out for Hong Kong adolescents: character strengths and positive thinking. Character strengths are a multidimensional set of positive traits that orient individuals toward valuing and pursuing virtuous actions (Park & Peterson, 2006). The VIA framework identifies 24 character strengths organized under six virtues—wisdom and knowledge, courage, humanity, justice, temperance, and transcendence—each comprising specific strengths such as creativity, perseverance, kindness, fairness, self-regulation, and hope (Peterson & Seligman, 2004). These strengths manifest in cognition, behaviour, and emotion and are relatively universal across cultures (Park et al., 2006). Higher levels of character strengths in adolescents are linked to fewer psychological problems, better academic performance (Niemiec, 2013), greater happiness (Park & Peterson, 2009), and higher life satisfaction (Peterson et al., 2007). Interventions that promote awareness and everyday use of character strengths have been shown, in meta-analyses, to enhance mental health, increase positive affect, and reduce psychological symptoms (Seligman et al., 2009; Schutte & Malouff, 2018), and school-based programmes targeting character strengths have improved adolescent well-being and academic outcomes while reducing distress (Waters, 2011).

Positive thinking has also gained prominence as a mechanism for building positive feelings, behaviours, and cognitions (Sin & Lyubomirsky, 2009). It can be understood as an optimistic cognitive style that supports problem solving and proactive behaviour (MacLeod & Conway, 2007), grounded in expectancy-value theory, which posits that expectations about future outcomes influence motivation and behaviour (Wigfield et al., 2017). Higher positive thinking is associated with more positive emotions and better overall well-being (Livingstone & Srivastava, 2012). Among adolescents, a positive outlook on the future is linked to lower school burnout (Martos Martínez et al., 2021), better academic achievement (Shane & Heckhausen, 2016; Schoon & Mortimer, 2017), and fewer symptoms of depression and anxiety (Skinner et al., 2022). Because character strengths and positive thinking can be framed as assets rather than symptoms, they may be less stigmatizing and more acceptable in high-pressure, performance-oriented school systems such as Hong Kong's. Yet, despite this robust international evidence and the theoretical fit with local educational priorities, character strengths and positive thinking have not been implemented at scale in Hong Kong adolescent prevention, leaving a clear research and practice gap.

1.3. Limitations of Existing Strength-Based Interventions in Hong Kong

Existing strength-based interventions for Hong Kong adolescents illustrate both potential and limitations. The programmes developed by Kwok et al. (2022) and Zhou et al. (2015) reported increases

in targeted strengths such as gratitude, hope, and emotional intelligence, whereas the revised Positively Kellett program documented decreases in intended outcomes (Blaine, 2024). Several recurring challenges can be identified.

First, most programmes adopt lesson-based, course-like formats with homework or extended curricula. In a context where academic excellence is prioritized and adolescents already face high academic load and stress (Cho & Chan, 2020; Lai et al., 2022), such formats can add to students' burdens rather than alleviating them. Even when targeted strengths improve, the additional time and effort may contribute to burnout, fatigue, or cumulative stress.

Second, these interventions depend heavily on the training, motivation, and consistency of teachers or social workers delivering the content. Variability in implementation across schools and personnel threatens both effectiveness and scalability.

Third, many programmes draw on Western-developed positive psychology frameworks that emphasize individual reflection and personal goal-setting (e.g., Kwok et al., 2022), with limited attention to the collectivist values prevalent in Chinese society, such as group harmony and interdependence. This raises concerns about cultural fit and may limit engagement and internalization.
Together, these issues highlight the need for brief, engaging, culturally congruent, and easily implemented strength-based interventions that: (a) can be slotted into existing timetables with minimal burden, (b) are delivered in a way that does not rely heavily on variable teacher training, (c) are framed around strengths and growth rather than disorder, and (d) explicitly cultivate character strengths and positive thinking in a manner resonant with local cultural values.

1.4. The "24 Flavors of Positive Thinking" (24F) Intervention

The "24 Flavors of Positive Thinking" (24F) programme was developed to address these service and research gaps. As a localized strength-based intervention, 24F focuses specifically on promoting positive thinking and character strengths in Hong Kong adolescents. Rather than delivering didactic lessons, it uses a context-based, ecological, and experiential design to embed strengths in narratives and media that are familiar and culturally meaningful.

The intervention comprises two activity formats. "Stories of CEOs" (CEO) invites CEOs from diverse Hong Kong industries, including business and sports, to share their pathways to success, including failures and setbacks. "Positive cinema" presents short excerpts from films focusing on themes of self, culture and society, and nature. Each CEO story or film segment is chosen to illustrate how particular character strengths and positive thinking are developed and applied. Both activities are facilitated by a psychologist who guides students to analyze how strengths and positive thinking operate in the narratives, recognize similar traits in themselves, apply these traits in their daily lives, and reflect on their own practice.

The programme is explicitly structured around four experiential components known to support behavioural and cognitive change—knowledge, personalization, action, and reflection (Kolb, 2014). Students gain knowledge of character strengths and positive thinking by dissecting the narratives; personalization occurs as they identify these traits in themselves and peers; action is prompted through encouragement to enact these traits in everyday situations; and reflection is fostered through guided self-assessment of how they have used these strengths.

This design aims to reduce burden and increase scalability by replacing course-like delivery with brief, highly engaging sessions that do not generate additional homework. At the same time, 24F is deliberately localized. All CEOs are based in Hong Kong and have navigated the city's competitive, fast-paced, excellence-driven culture. Film clips are selected to resonate with Chinese cultural values; for example, an excerpt from *Confucius* incorporates themes such as loyalty and modesty as the protagonist confronts ethical dilemmas. These choices embed character strengths and positive thinking within culturally familiar narratives of effort, responsibility, and moral conduct, potentially reducing stigma and increasing relevance for Hong Kong adolescents.

1.5. The Present Study

The present research evaluates whether a brief, culturally grounded, strengths-based programme such as 24F can meaningfully enhance positive thinking and character strengths when delivered under real-world school conditions. Specifically, we address two key implementation questions that have received little attention in the existing literature: delivery format and dosage.

We conducted a quasi-experimental study to examine changes in positive thinking and character strengths among Hong Kong Chinese adolescents exposed to: (1) two activity formats-CEO stories versus positive cinema; and (2) two dosage levels—one versus two sessions. This design allows us to test not only whether 24F is effective, but also whether narrative format and dose influence its impact, thereby directly informing decisions about scalability and feasibility.

We hypothesized that: (H1) both activity formats would similarly enhance positive thinking, with higher dosage producing larger gains in positive thinking traits; (H2) there would be no significant interaction between activity format and dosage; and (H3) both formats would yield improvements in character strengths. By addressing explicit service and research gaps in current school-based mental health initiatives, this study contributes new evidence on how brief, strengths-based, culturally tailored interventions can be implemented to promote adolescent mental health in Hong Kong.

2. Method

2.1. Participants

A total of 1,454 adolescents from six secondary schools and two NGOs participated in the study. All participants were recruited through poster advertisements, announcements, and social media posts (e.g., Instagram, Snapchat). The study comprised a briefing session followed by various study sessions. During the briefing session, the research team introduced the study to the attendees and addressed their inquiries. Individuals interested in participating were then asked to provide informed consent and complete a pre-intervention survey. Participants were eligible if they were at least 12 years old and capable of providing informed consent. They were informed of the voluntary nature of the study and their right to withdraw at any time without needing to provide an explanation or face any penalties.

2.2. Procedures

A quasi-experimental research design was used in which each school or NGO was assigned to one of five groups: one CEO session (low CEO), one positive cinema session (low cinema), two CEO sessions (high CEO), two positive cinema sessions (high cinema), and a control group with no activities. The first four groups served as experimental groups. Following the briefing session, all four experimental groups completed their interventions and a post-intervention survey. Each intervention session lasted 90 minutes and included warm-up exercises, an intervention activity, and discussions. Each survey took approximately 20 minutes to complete. Control participants completed the post-intervention survey upon the implementation of all intervention sessions. All study sessions were conducted at partnership schools from which the participants were recruited. All study procedures were approved by the University of Hong Kong ethics committee.

Among the 1,454 recruited participants, 110 were excluded for the following reasons: 71 failed to report the activities they completed, 22 did not complete the pre-intervention survey, and 17 did not complete the post-intervention survey. These exclusions resulted in a final analytic sample of 1,344 participants, with 824 (59.5%) in the low CEO group, 368 (26.6%) in the low cinema group, 54 (3.9%) in the high CEO group, 57 (4.1%) in the high cinema group, and 41 (3.0%) in the control group. The age and gender characteristics of each group are presented in Table 1.

2.3. Measures

All measures were written in both Chinese and English and were conducted in a paper-and-pencil format.

2.3.1. Pre-Intervention Survey

Positive thinking. The survey included 13 items designed by the research team after consulting experts in the Youth Development Commission. The questionnaire aligns with the meta-theoretical framework of Positive Youth Development (PYD; Lerner et al., 2005), connecting the individual strengths (e.g., resilience, self-efficacy) with ecological assets (e.g., supportive relationships, opportunities); and Seligman's PERMA Model (2002), where positive thinking ties to positive emotion, engagement (proactive thinking) and meaning (self-worth and prosocial orientation). It measures components of future orientation, self-worth, resilience, and prosocial orientation. The items were adapted from Synder et al.'s (1991, 1997) *Children's Hope Scale/ Adult's Hope Scale*, *General Self-Efficacy Scale (GSE)-Youth Version* (Schwarzer & Jerusalem, 1995), Caprara et al.'s (2012) *Positive Scale*, *Design My Future scale* (Santilli et al., 2015), and *Resilience Scale for Adolescents (READ)* (Hjemdal et al., 2006). A sample item measuring positive thinking about the future orientation is "I have a clear sense of direction for the future." Participants reported their agreement to each item using a 7-point Likert rating scale ranging from 1 *strongly disagree* to 7 *strongly agree*. The scores of the 13 items were averaged to compute an overall positive thinking score for each participant. The Cronbach's alpha of the scale in the current study is 0.91.

Strongest and weakest character strengths. Participants indicated their three strongest and three weakest character strengths among the 24 strengths (Shimai & Urata, 2023).

Demographic variables. Participants also reported brief demographic details such as age, gender, grade, and special educational needs.

2.3.2. Post-Intervention Survey

Positive thinking. The post-intervention survey included 18 items designed to measure the same seven factors related to positive thinking as the pre-intervention survey. The same 7-point Likert rating scale was used. The scores of the 18 items were averaged to compute an overall positive thinking score for each participant.

Strongest and weakest character strengths. Identical to the pre-intervention survey, participants indicated their three strongest and three weakest character strengths among the 24 strengths (Shimai & Urata, 2023).

Satisfaction with intervention. For the four experimental groups, two additional items were used to measure their overall satisfaction with the intervention. A sample item was "Overall, do you agree that participating in this program helps build a positive vision of life?" Participants rated the items using a 4-point Likert rating scale ranging from 1 *strongly disagree/very dissatisfied* to 4 *strongly agree/very satisfied*. The scores of the two items were averaged to compute an overall satisfaction score for each participant.

2.4. Analytic Plan

All effectiveness analyses were based on cluster-aware mixed-effects models estimated in SPSS 29 (IBM, 2025). Before testing intervention effects, the clustered quasi-experimental structure was summarised and preliminary checks were conducted. First, a random-intercept linear mixed model with school/NGO as the clustering factor and baseline positive thinking as the outcome was fitted to estimate the intraclass correlation coefficient (ICC) for baseline positive thinking. Then, baseline comparability across the five conditions (low-dose CEO, high-dose CEO, low-dose cinema, high-dose cinema, control) was examined using mixed models with school/NGO random intercepts, comparing baseline positive thinking and key demographics (age, gender, grade).

For the main analysis, five sets of analyses were conducted, including primary, secondary, satisfaction, character strength, and sensitivity analysis. The primary analysis was to evaluate intervention effects on positive thinking at the last available post-intervention assessment. For each student, the last post-intervention survey (post for low-dose groups; final post for high-dose groups) was used. First, a mixed-effects ANCOVA at the student level was fitted with last-post positive thinking as the dependent variable, baseline positive thinking as a covariate, and the five-level condition factor as the main predictor. A random intercept for school/NGO was included to account

for clustering. Second, among the four experimental arms, a factorial mixed-effects ANCOVA was fitted to disentangle the effects of activity format and dosage. In this model, last-post positive thinking was regressed on baseline positive thinking, activity (CEO vs. cinema), dosage (low vs. high), and the activity x dosage interaction, with a random intercept for school/NGO. This model tested (a) the main effect of dosage (two sessions vs. one session), (b) the main effect of activity format (CEO vs. cinema), and (c) whether the effect of dosage differed by activity format.

The secondary analysis examined change in positive thinking over time using mixed-effects models with repeated measures. For all five conditions, we fit a two-timepoint linear mixed model to stacked data containing baseline and last-post positive thinking for each student. We initially specified a model with separate random intercepts for both school/NGO and student (i.e., two random-effect levels), but this proved numerically unstable and computationally inefficient in SPSS given the very small number of clusters, unbalanced cluster sizes, and only two timepoints per student. The final model therefore retained a random intercept for school/NGO and represented within-student correlation using a compound symmetry (CS) repeated structure.

For two-timepoint data, this REPEATED CS specification is mathematically equivalent to including a student-level random intercept in a random-intercept model. It thus appropriately accounts for the non-independence of repeated measures within students while yielding more stable estimation. This model tested whether changes in positive thinking from baseline to last post differed across conditions, and it produced model-based pre- and post-means and change scores with confidence intervals. For the two high-dose conditions (high CEO and high cinema), we additionally fit a three-timepoint mixed model, treating time as 0 (baseline), 1 (after the first session), and 2 (after the second session). Time, activity (CEO vs. cinema), and their interaction were included as fixed effects, with the same random and repeated structure as above. This trajectory model examined whether positive thinking improved from T1 to T3 and whether trajectories differed by activity format.

The satisfaction analysis focused on intervention satisfaction among the four experimental groups. Overall satisfaction at the last post-intervention assessment (four-point scale) was treated as an approximately continuous outcome. We fit a linear mixed model with activity (CEO vs. cinema), dosage (low vs. high), and their interaction as fixed effects, and a random intercept for school/NGO. This model provided adjusted mean satisfaction scores for each activity x dosage cell and tested the main effects of dosage and activity, as well as their interaction.

Furthermore, in order to explore changes in character strengths, binary indicators were created for whether each of six focal VIA strengths (kindness, love, bravery, humour, self-regulation, and hope) was selected as one of the three strongest strengths at baseline and at the last post-intervention assessment. Frequencies and proportions for these binary indicators were tabulated by condition and time to describe pre- to post-changes in the endorsement of focal strengths as “strongest”. Given the large number of possible strengths and the exploratory nature of these outcomes, analyses of character strengths were treated as secondary and interpreted cautiously.

Character strength analyses were conducted to examine intervention-related changes in selected character strengths. First, we examined the frequencies of the three strongest and three weakest character strengths reported on the pre- and post-intervention surveys. We analyzed the increases in strong strengths and decreases in weak strengths for each group. Then, six focal strengths that were theoretically linked to the intervention content (bravery, hope, humour, kindness, love, and self-regulation) were specified a priori. For each strength, a binary indicator was created at each time point (baseline and immediate post-session), coded 1 if the strength was endorsed among the three strongest character strengths and 0 otherwise. For each focal strength, a logistic mixed-effects regression model with a logit link was fitted, with Time (pre vs. post), Condition (Low CEO, High CEO, Low cinema, High cinema), and their interaction as fixed effects. Random intercepts for school/NGO and student were included to account for clustering of students within institutions and repeated measurements within students. Model parameters were summarised as odds ratios (ORs) with 95% confidence

intervals (CIs). All character-strength analyses were treated as secondary outcomes. To control for multiple testing, Benjamini-Hochberg false-discovery-rate correction was applied across the 18 Time x Condition interaction tests (six strengths x three non-reference conditions).

Finally, the sensitivity analysis was conducted to evaluate the robustness of the primary conclusions. First, the primary mixed-effects ANCOVA for last-post positive thinking was refitted with additional covariates (age, and separately grade; in an extended model, age, gender, and SEN status) to assess whether intervention effects were robust to baseline demographic imbalances. Second, an alternative mixed-effects model was estimated using change scores (post − pre) as the outcome instead of the ANCOVA specification, to check whether conclusions were consistent across outcome parameterisations. Third, a marginal model for last-post positive thinking was estimated using generalised estimating equations (GEE) with school/NGO as the clustering unit and robust (sandwich) standard errors to compare results obtained under random-effects and cluster-robust approaches; however, with only nine clusters, Wald tests for condition were numerically unstable, and inferences therefore relied on the mixed-effects models. Across linear mixed models, restricted maximum likelihood (REML) estimation and Satterthwaite-type degrees of freedom for fixed effects were used. All analyses were conducted in SPSS 29.

3. Results

3.1. Descriptive analysis

Table 1 summarises baseline characteristics for the five conditions. The analytic sample comprised 1,344 students nested within 9 school/NGO clusters and assigned to five conditions: low CEO (n = 824), low cinema (n = 368), high CEO (n = 54), high cinema (n = 57), and control (n = 41). Mean age ranged from 14.4 years (SD = 1.7; low CEO) to 15.9 years (SD = 0.7; high CEO) across conditions, and the gender distribution was approximately balanced, with about half of students identifying as male in most groups (49.8–53.7%), except for the high-cinema group which included a higher proportion of girls (63.2%). Baseline positive thinking scores also varied descriptively, from M = 4.26 (SD = 0.81) in the control group to M = 5.14 (SD = 0.93) in the high-CEO group. A null random-intercept model for baseline positive thinking with school/NGO as the clustering unit yielded an ICC of approximately 0.03, indicating that about 3% of the variance in baseline positive thinking was attributable to between-cluster differences. This supported the use of cluster-adjusted mixed-effects models in subsequent analyses.

Cluster-adjusted tests indicated significant baseline differences in positive thinking across the five conditions, $F(4, 77.31) = 3.90$, $p = .006$. Estimated marginal means ranged from 4.30 in the control group to 5.12 in the high-CEO group, indicating that students in all four intervention conditions started with somewhat higher positive-thinking scores than those in the control condition. Age and grade also differed significantly across conditions ($F(4, 1245.09) = 242.13$, $p < .001$ for age; $F(4, 1314.71) = 349.88$, $p < .001$ for grade), whereas the proportion of female students did not ($F(4, 124.80) = 1.29$, $p = .277$). These baseline imbalances motivated the inclusion of baseline positive thinking as a covariate in all primary models and the use of demographic covariates (age or grade, but not both simultaneously because of collinearity) in sensitivity analyses.

Table 1. Baseline characteristics of students by condition

		Age		Gender	Baseline positive thinking	
	N	*M*	*SD*	Female, n (%)	*M*	*SD*
Low CEO	824	14.44	1.71	414 (50.23%)	4.81	0.99
High CEO	54	15.93	0.70	25 (46.31%)	5.14	0.93
Low Cinema	368	15.68	1.00	178 (48.42%)	4.84	0.96

High Cinema	57	14.53	1.30	36 (63.22%)	4.88	0.73
Control	41	15.46	1.38	21 (51.23%)	4.26	0.81
Total	1,344	14.89	1.60	674 (50.15%)	4.82	0.97

Note. Intraclass correlation coefficient (ICC) for baseline positive thinking from a null mixed model with a random intercept for school/NGO was ≈ 0.03, indicating that about 3% of the variance in baseline scores was attributable to between-cluster differences. Cluster-adjusted tests indicated significant baseline differences between conditions in baseline positive thinking, age, and grade (all *ps* < .01), whereas gender did not differ significantly across conditions ($p = .277$).

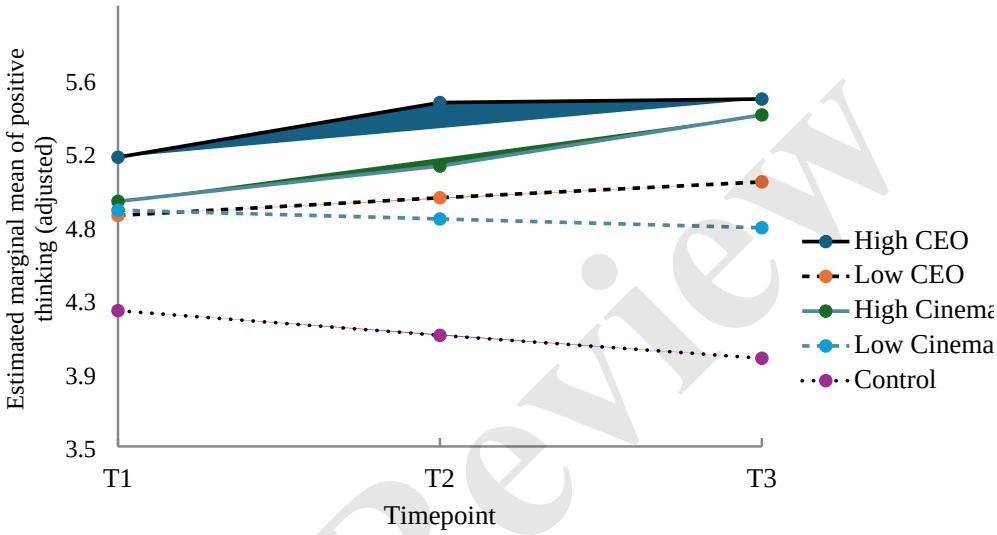
3.2. Primary analysis

The mixed-effects ANCOVA show that baseline positive thinking was a strong predictor of post-intervention scores, $F(1, 1257.23) = 535.01$, $p < .001$, and condition also had a significant overall effect on post-intervention positive thinking, $F(4, 104.52) = 13.21$, $p < .001$.

The mixed-effects ANCOVA showed that baseline positive thinking was a strong predictor of post-intervention scores, $F(1, 1257.23) = 535.01$, $p < .001$, and condition also had a significant overall effect on post-intervention positive thinking, $F(4, 104.52) = 13.21$, $p < .001$. Estimated marginal means (adjusted to the sample mean of baseline positive thinking) indicated that all four intervention conditions obtained higher post-intervention positive thinking scores than the control group (see Figure 1). Adjusted means were approximately 5.01 for low CEO, 4.73 for low cinema, 5.27 for high CEO, and 5.34 for high cinema, compared with 4.35 for the control condition. Relative to the control group, adjusted mean differences were 0.66 for low CEO, 0.38 for low cinema, 0.92 for high CEO, and 0.99 for high cinema. Standardising these differences by the model-based residual standard deviation (SD ≈ 0.97) yielded medium effects for the low-dose conditions (g ≈ 0.39 - 0.68) and large effects for the high-dose conditions (g ≈ 0.95 - 1.02), indicating stronger gains under higher dosage, supporting H1 and H2. Consistent with this pattern, among the intervention arms, dosage showed a robust main effect, $F(1, 73.25) = 20.20$, $p < .001$, with high-dose conditions scoring higher than low-dose conditions by approximately 0.61 points (g ≈ 0.63), whereas neither the main effect of activity format (CEO vs positive cinema), $F(1, 211.01) = 1.19$, $p = .277$, nor the activity x dosage interaction, $F(1, 117.83) = 3.27$, $p = .073$, was significant. These results suggest that improvements in positive thinking were primarily attributable to dosage rather than activity format, further supporting H2.

Figure 1. Model-estimated trajectories of positive thinking by condition across measurement occasions.

Note. Lines show estimated marginal means of positive thinking for each condition (low CEO, low



cinema, high CEO, high cinema, control) at three measurement occasions: Baseline (T1), After first session (T2), and Final follow-up (T3). Means are derived from mixed-effects models that adjust for baseline positive thinking and clustering by school/NGO. High-dose conditions (high CEO, high cinema) were assessed at all three occasions. Low-dose and control conditions were assessed at T1 and T3 only; any apparent value at T2 for these groups is a linear interpolation for display purposes and does not reflect an observed or model-estimated T2 value.

3.3. Secondary analysis

To further examine whether changes in positive thinking over time differed by activity format (CEO stories vs positive cinema) and dosage (low vs high), a repeated-measures mixed model was fitted to evaluate change from baseline to the final follow-up across the five conditions. The result showed a small but significant overall improvement, $F(1, 1339.00) = 6.16$, $p = .013$, and a robust main effect of condition, $F(4, 91.56) = 9.82$, $p < .001$. Importantly, the Time x Condition interaction was also significant, $F(4, 1339.00) = 9.14$, $p < .001$, indicating that the magnitude and direction of change differed across groups. Model-estimated means (see Table 2) indicated that positive thinking decreased slightly in the control group from baseline (M = 4.32) to the final follow-up (M = 4.06; Δ = -0.27), and remained essentially stable in the low-cinema condition (Δ = −0.10). In contrast, the low-CEO condition showed a modest increase (Δ = +0.19), and both high-dose conditions exhibited more substantial gains (Δ = +0.50 for High-Cinema, and Δ = +0.33 for High-CEO). These results show that intervention arms—especially the high dosage CEO and cinema conditions—were associated with greater improvements in positive thinking over time than thecontrol condition.

Table 2. Model-estimated change in positive thinking from baseline to final follow-up by condition

	Change T1-> T3		95% CI for Δ		
Condition	*Δ*	*SE*	*Lower Bound*	*Upper Bound*	*P*
Low CEO	0.19	0.04	0.12	0.26	<.001

Low cinema	-0.10	0.05	-0.21	0.00	0.058
High CEO	0.33	0.14	0.05	0.06	0.007
High cinema	0.50	0.13	0.25	0.75	<.001
Control	-0.27	0.16	-0.58	0.50	0.09

Note. Values are model-estimated marginal means (EMMs) from a two-timepoint linear mixed-effects model with Time (baseline vs final follow-up), Condition (low CEO, low cinema, high CEO, high cinema, control), and their interaction as fixed effects, a random intercept for school/NGO, and a compound-symmetry repeated structure for Time within students. Δ = change from baseline to final follow-up (Last – Pre); SE = standard error; CI = 95% confidence interval. Positive Δ reflects improvement in positive thinking. P-values are based on Satterthwaite approximations.

To characterise trajectories within the high-dose conditions, a three-timepoint mixed model was estimated for the high-CEO and high-cinema groups only. The model indicated a significant main effect of Time, $F(2, 218.00) = 15.60$, $p < .001$, whereas the main effect of Content, $F(1, 109.00) = 2.32$, $p = .130$, and the Time x Content interaction, $F(2, 218.00) = 1.56$, $p = .212$, were not statistically significant. Thus, positive thinking increased over time in the high-dose conditions, with broadly similar trajectories for CEO and cinema. Estimated means in the high-CEO group increased from 5.14 at T1 to 5.45 at T2 and 5.47 at T3 (T1→T3 Δ = +0.33), with the within-group time effect reaching significance, $F(2, 218.00) = 5.88$, $p = .003$. In the high-cinema group, estimated means increased from 4.89 at T1 to 5.09 at T2 and 5.38 at T3 (T1→T3 Δ = +0.50), with a significant within-group time effect, $F(2, 218.00) = 11.43$, $p < .001$. Post-hoc comparisons indicated that, in both high-dose conditions, scores at the final follow-up were significantly higher than at baseline, and for high cinema, the T3 scores were also significantly higher than at T2. These trajectories are consistent with the primary and two-timepoint models in demonstrating that high-dose CEO and cinema interventions are associated with sustained improvements in positive thinking.

3.4. Satisfaction analysis

Satisfaction with the intervention was generally high across conditions. The intraclass correlation for satisfaction was very small (ICC ≈ .001), indicating negligible between-cluster variance, but clustering was retained in the model for consistency with other analyses. Dosage showed a robust main effect on satisfaction, $F(1, 91.01) = 13.38$, $p < .001$. Model-estimated means indicated that students in the high-dose conditions reported higher satisfaction (CEO: M = 3.24, SE = 0.08; cinema: M = 3.32, SE = 0.08) than those in the low-dose conditions (CEO: M = 3.12, SE = 0.02; cinema: M = 2.99, SE = 0.04). In contrast, the main effect of content was not significant, $F(1, 183.20) = 0.17$, $p = .684$, and the content x dosage interaction was not significant, $F(1, 124.27) = 3.09$, $p = .081$, although satisfaction appeared somewhat higher in the high-dose cinema group than in the other three groups. These results suggest that completing two sessions, regardless of whether the activity was CEO or cinema, was associated with higher perceived satisfaction than completing a single session.

3.5. Character Strength analysis

3.5.1. Strongest Character Strengths

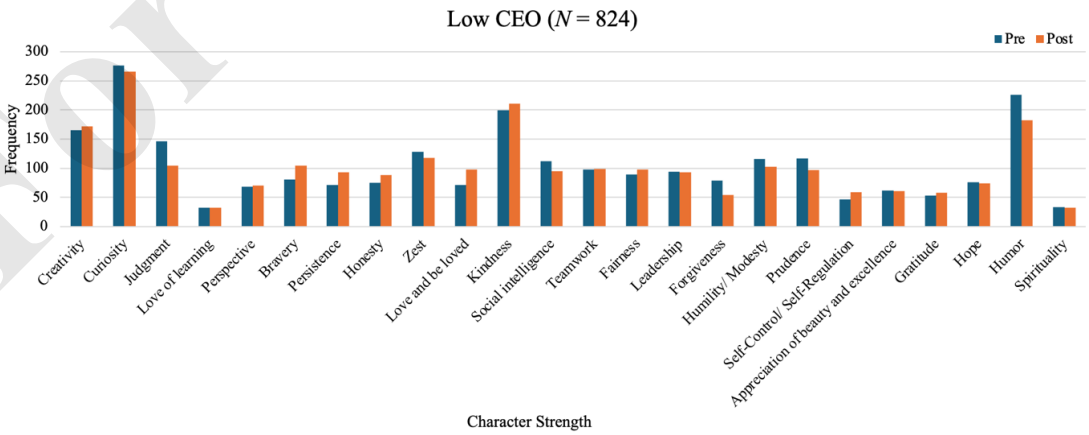
Frequencies of the three strongest character strengths reported by each group on the pre- and post-intervention surveys are presented in Figure 2. On the pre-intervention survey, curiosity was the most frequently reported strength in all experimental and control groups. It was reported by 276 (33.5%), 133 (36.1%), 23 (42.6%), 18 (31.6%), and 19 (46.3%) participants in the low CEO, low cinema, high CEO, high cinema, and control groups, respectively. On the post-intervention survey, curiosity was also the most frequently reported strength in the low CEO ($n = 266$, 32.3%), low cinema ($n = 150$, 40.8%), high cinema ($n = 19$, 31.6%), and control groups ($n = 12$, 29.3%), while kindness was the most frequently reported in the high CEO group ($n = 25$, 46.3%), suggesting potential enhancement of kindness following two CEO sessions.

Different character strengths exhibited the greatest increase in the reporting frequency post-intervention in each group. For the low CEO group (Panel A in Fig. 2), love and be loved exhibited the greatest increase, in which it was reported by 71 (8.6%) participants pre-intervention and 98 (11.9%) participants post-intervention, with an increase of 27 (3.3%) following intervention. For the low cinema group (Panel B in Fig. 2), humor exhibited the greatest increase in the reporting frequency, in which it was reported by 91 (24.7%) participants pre-intervention and 140 (38.0%) participants post-intervention, with an increase of 49 (13.3%) following intervention.

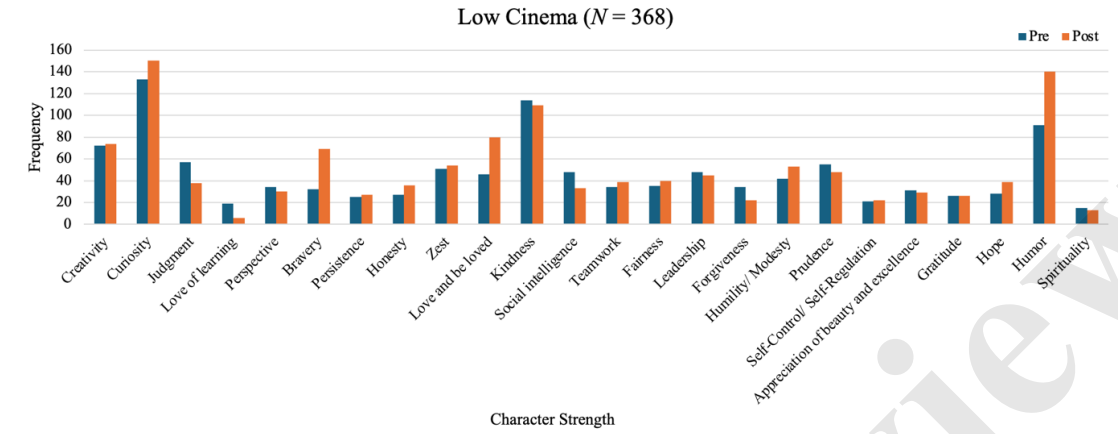
For the high CEO group (Panel C in Fig. 2), kindness exhibited the greatest increase in the reporting frequency, in which it was reported by 17 (31.5%) participants pre-intervention and 25 (46.3%) participants post-intervention, with an increase of 8 (14.8%) following intervention. For the high cinema group (Panel D in Fig. 2), bravery exhibited the greatest increase in the reporting frequency, in which it was reported by 9 (15.8%) participants pre-intervention and 13 (22.8%) participants post-intervention, with an increase of 4 (7.0%) following intervention. For the control group (Panel E in Fig. 2), persistence, kindness, and appreciation equally exhibited the greatest increase, with 3 (7.3%) more participants reporting those strengths following intervention. Taken together, the results supported H3.

Figure 2. Strongest Character Strengths Reported on Pre- and Post-Intervention Surveys

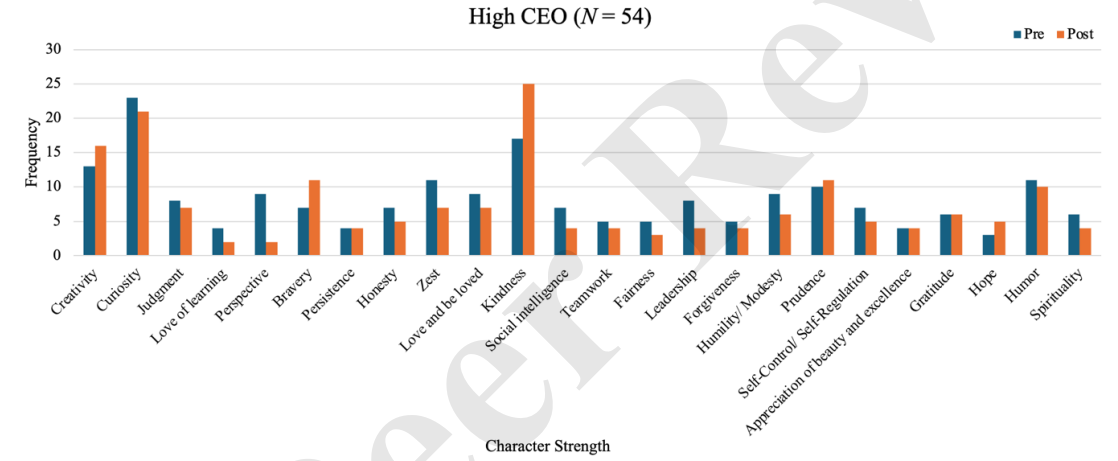
A)



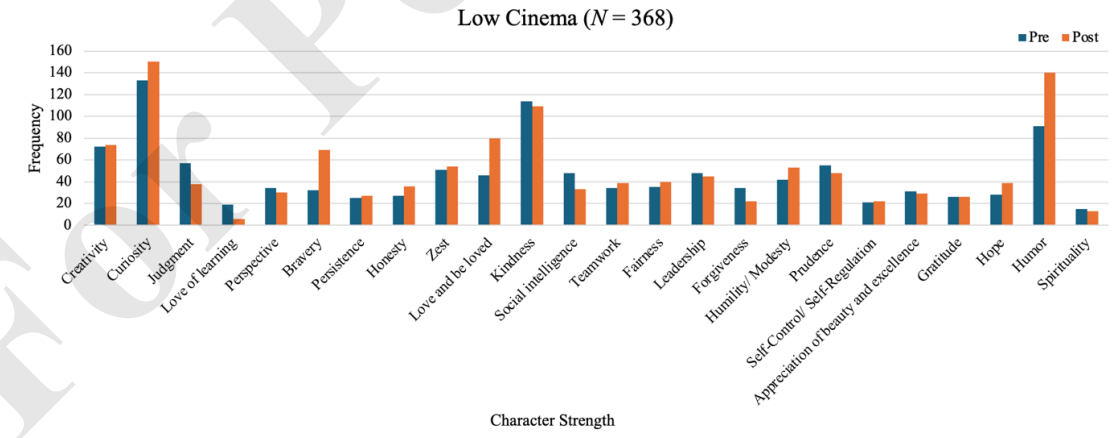
B)



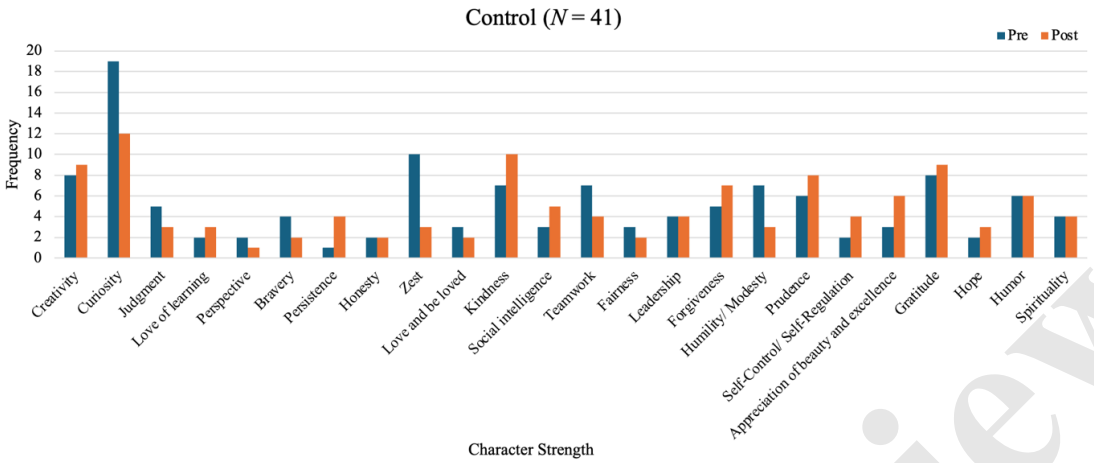
C)



D)



E)



Note: Pre = pre-intervention survey; Post = last post-intervention survey. Each participant was asked to indicate three character strengths.

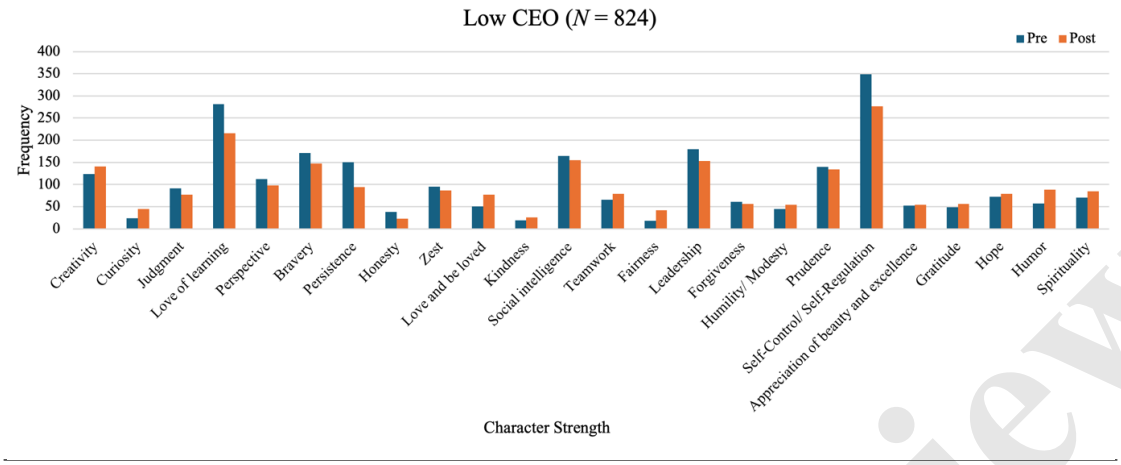
3.5.2. Weakest Character Strengths

Frequencies of the three weakest character strengths reported by each group on the pre- and post-intervention surveys are presented in Figure 3. On the pre-intervention survey, self-control/self-regulation was the most frequently reported weakness in the low CEO (n = 349, 42.4%), high CEO (n = 17, 31.5%), and control groups (n = 17, 41.5%). Creativity was the most frequently reported weakness in the low CEO (n = 255, 69.3%) group, while love of learning was the most frequently reported weakness in the high cinema (n = 23, 40.4%) group. On the post-intervention survey, self-control/self-regulation was also the most frequently reported weakness in all experimental and control groups. It was reported by 277 (33.5%), 125 (34.0%), 15 (27.8%), 22 (38.6%), and 14 (34.1%) participants in the low CEO, low cinema, high CEO, high cinema, and control groups, respectively.

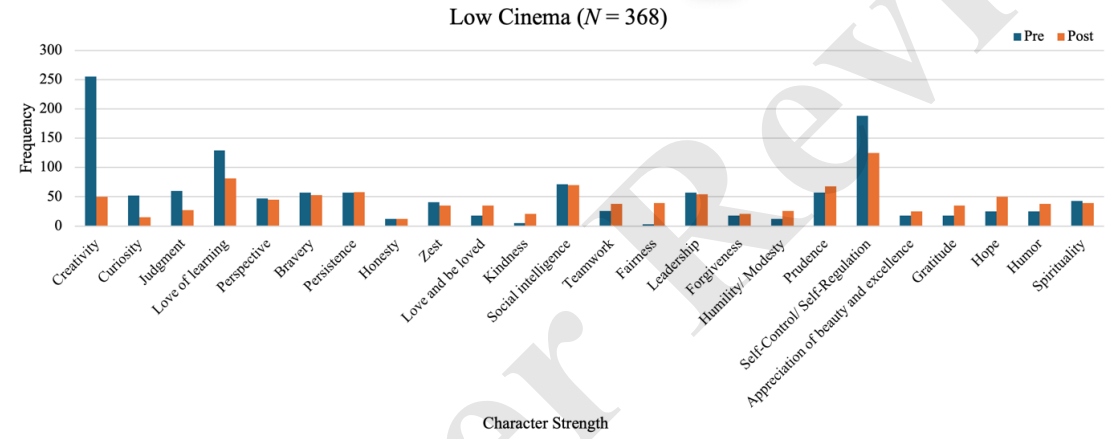
Different character strengths exhibited the greatest decrease in the reporting frequency post-intervention in each group. Among the low CEO (Panel A in Fig. 3), low cinema (Panel B in Fig. 3), high CEO (Panel C in Fig. 3), and high cinema (Panel D in Fig. 3) groups, self-control/self-regulation, creativity, bravery, and forgiveness exhibited the greatest decrease in the reporting frequency. For the control group (Panel E in Fig. 3), love and be loved exhibited the greatest decrease in the reporting frequency. Again, the results supported H3.

Figure 3. Weakest Character Strengths Reported on Pre- and Post-Intervention Surveys

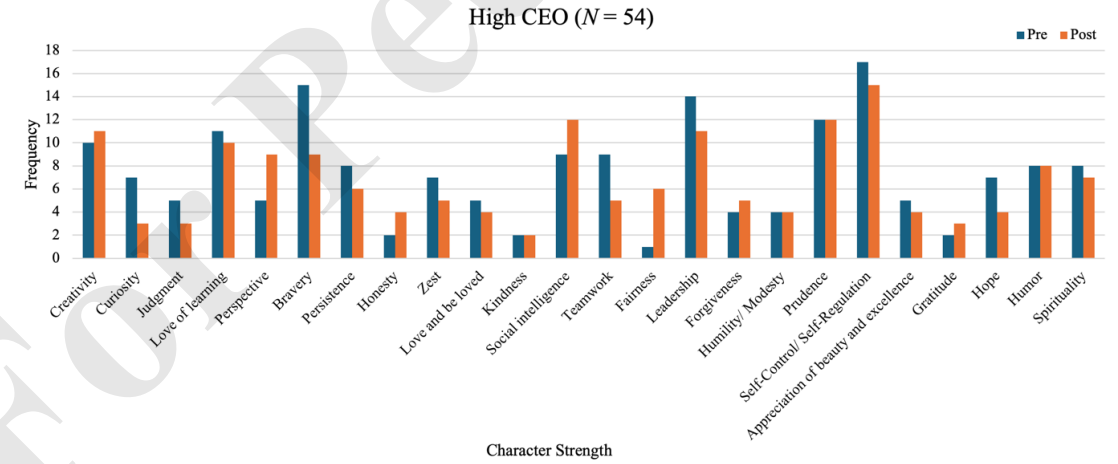
A)



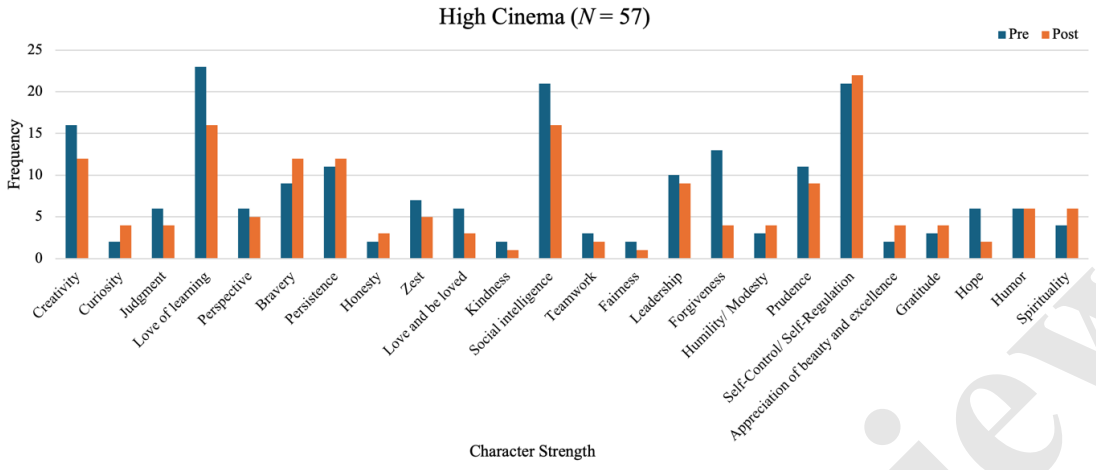
B)



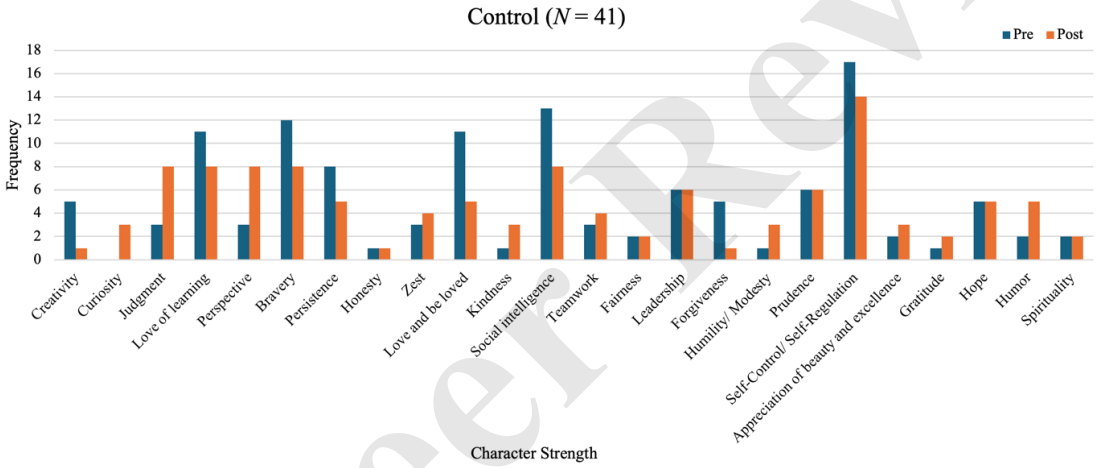
C)



D)



E)



Note: Pre = pre-intervention survey; Post = last post-intervention survey. Each participant was asked to indicate three character strengths.

3.5.3. Changes in Character Strengh Pre- and Post- Intervention

Within the reference condition (Low CEO), bravery showed a significant pre–post increase (OR = 2.77, 95% CI [1.61, 4.77], $p < .001$), indicating that students in this group were more likely to endorse bravery among their three strongest character strengths after the session. Combining the main effect of Time and the interaction terms, the estimated pre–post odds ratios for bravery were approximately 40.95 in High CEO, 4.63 in Low cinema, and 23.93 in High cinema, suggesting that bravery endorsement tended to rise in all intervention arms. The critical test, however, is whether these changes differed between conditions. Compared with Low CEO, the increase in bravery was much larger in the High CEO condition (Time x Group OR = 14.76, 95% CI [4.48, 48.61], raw $p < .001$, FDR-adjusted $p = .00017$), whereas the additional changes in the Low and High cinema groups did not differ significantly from Low CEO (both FDR-adjusted ps ≈ 1.00).

For the other focal strengths (hope, humour, kindness, love, and self-regulation), the models did not reveal any reliable between-condition differences in pre–post change. In the Low CEO group, kindness and love showed significant decreases in endorsement as "top three" strengths (kindness: OR = 0.14, 95% CI [0.09, 0.21], p < .001; love: OR = 0.01, 95% CI [0.00, 0.03], p < .001), and similar decreases were observed in the other intervention arms, but none of the corresponding Time × Condition interactions survived FDR correction (all FDR-adjusted ps ≥ .73). For hope, humour, and

self-regulation, estimated odds ratios for pre–post change were extremely small with wide confidence intervals across all groups, reflecting very low endorsement rates and providing no evidence of systematic or differential change over time.

3.6. Sensitivity analysis

A series of sensitivity analyses were conducted to examine the robustness of the primary mixed-effects ANCOVA. First, cluster-adjusted models additionally controlling for baseline imbalances in age, grade, gender, and SEN were estimated. When age was included as a covariate, baseline positive thinking and age were both significant predictors of post-intervention scores, $F(1, 1334) = 528.79$, $p < .001$ and $F(1, 1334) = 4.54$, $p = .033$, respectively, yet the overall effect of condition remained robust, $F(4, 1334) = 11.23$, $p < .001$. Estimated differences between each intervention group and the control condition were identical to the primary model (e.g., adjusted mean differences ranging from 0.39 to 0.96 points on the positive thinking scale; all $ps \leq .015$). In the model adjusting for grade instead of age, grade had a small overall effect on post-intervention scores, $F(7, 200.71) = 2.35$, $p = .025$, while the condition effect remained statistically significant, $F(4, 43.22) = 5.36$, $p = .001$. The pattern of group differences was unchanged for three of the four intervention arms (low-CEO, high-CEO, high-cinema remained significantly higher than control), although the low-cinema vs control contrast was attenuated and no longer significant at the 5% level.

A further model simultaneously controlling for age, gender, and SEN again produced nearly identical estimates for the intervention effects. Baseline positive thinking remained a strong predictor of outcomes, $F(1, 1330) = 532.88$, $p < .001$, and small additional effects of age and gender were observed (older students and boys showed slightly lower adjusted post-intervention scores). Nonetheless, the main effect of condition was stable, $F(4, 1330) = 11.02$, $p < .001$, with adjusted mean differences versus control ranging from approximately 0.39 to 0.94 points across the four intervention arms (all $ps \leq .014$).

As an alternative outcome specification, a cluster-adjusted model was estimated using the change in positive thinking from baseline to final follow-up (post - pre) as the dependent variable, with baseline positive thinking included as a covariate. In this change-score formulation, condition continued to show a strong overall effect, $F(4, 104.52) = 13.21$, $p < .001$. Estimated mean change scores indicated that positive thinking declined in the control group ($\Delta \approx -0.47$), kept stable in the low-cinema group ($\Delta \approx -0.09$), and increased in the low-CEO ($\Delta \approx +0.19$) and both high-dose groups ($\Delta \approx +0.45$ for high-CEO, $\Delta \approx +0.52$ for high-cinema). Thus, the pattern of intervention effects was highly consistent whether the outcome was modelled as a baseline-adjusted post-score or as a change score.

Finally, a generalized estimating equations (GEE) model with robust, cluster-adjusted standard errors and an exchangeable working correlation structure was explored as an additional robustness check. In this model, the effect of baseline positive thinking remained highly significant (Wald $\chi^2 = 353.09$, $p < .001$), but the estimates for the condition effect showed numerical instability (very large standard errors and failure to compute valid Wald tests), most likely due to the small number of clusters and substantial imbalance in cluster sizes. Because of these estimation problems, the GEE results were not used for substantive inference. Given the strong and consistent pattern of effects observed across the covariate-adjusted mixed-effects models and the alternative change-score specification, the mixed-effects ANCOVA was retained as the primary and most reliable analytic approach

4. Discussion

We evaluated the effectiveness of our newly developed 24F program, aimed at fostering positive thinking and character strengths among adolescents using a context-based and ecological approach, which is the first of its kind in Hong Kong. The intervention incorporates localized, real-life examples from CEOs and fictional experiences of movie characters to equip adolescents with positive traits, specifically positive thinking and character strengths, that have been shown to lead to positive life outcomes. Using a quasi-experimental design, we tested the effects of CEO versus positive cinema, the impact of low versus high dosage, and their interaction effects on positive thinking and character

strengths. The results indicated that both types of activities were effective with only single dose, with greater dosage resulting in more significant improvements.

The significant increases in positive thinking in all experimental groups following the intervention underscore its effectiveness in fostering a more positive outlook on various aspects of life, such as the future, self-worth, and social relationships. With an enhanced positive attitude, adolescents are likely to approach stressors with greater confidence and a proactive mindset, ultimately contributing to improved overall well-being. The significant impact of dosage on positive thinking also highlights the cumulative effects of the intervention sessions, further emphasizing the positive changes that the intervention can bring to participants.

In terms of character strengths, the greatest increases were observed in love and being loved, humour, kindness, and bravery, while substantial decreases were found in self-control/self-regulation, creativity, bravery, and forgiveness among the low CEO, low cinema, high CEO, and high cinema groups, respectively, following the intervention. Furthermore, cluster-aware logistic mixed-effects models focusing on six focal strengths suggested that bravery endorsement increased from pre to post across intervention arms, and that the increase was most pronounced in the high-dose CEO condition relative to the low-dose CEO condition. These findings suggest that the intervention has the potential to significantly shape various character strengths. However, it is noteworthy that participants in the control group also exhibited changes in their strongest and weakest character strengths between the pre- and post-test measures. These findings should be interpreted collectively, as they can be explained by several factors, each carrying different implications.

One possible explanation for the positive changes in character strengths observed in the experimental groups is that the intervention was effective in enhancing various strengths. If this is the case, a plausible reason for the observed changes in the control group may be the social connections among participants. Given that many participants were recruited from the same schools or NGOs, individuals in the control group were likely friends with those in the experimental groups. This social dynamic could have facilitated communication between the groups, allowing control participants to gain insights into the content and experiences of the 24F program. Consequently, such interactions might lead control participants to inadvertently imitate the treatment effects seen in the experimental group or report biased outcomes due to social influence. A second possible explanation is that all participants, both in the experimental and control groups, may have naturally developed certain character strengths over time. As adolescence is a critical developmental period characterized by significant emotional, social, and cognitive changes, the participants may have engaged in new experiences or activities, faced changes in relationships, or confronted life challenges during the period between the pre- and post-measures, which could have contributed to the evolution of their character strengths. The implication would be that even without formal interventions, adolescents may experience growth in their character strengths simply through their daily interactions and experiences within their communities. Further research is needed to determine which of the possible explanations is supported and to identify the underlying causes of changes in character strengths.

Overall, participants expressed satisfaction with the program, with those receiving a greater dosage reporting higher levels of satisfaction. Given the lack of culturally sensitive strength-based interventions for adolescents in Hong Kong, our findings provide encouraging evidence that the newly developed 24F intervention program is effective in promoting positive thinking and character strengths within this population.

4.1. Practical Implications

The evaluation of the 24F program yields several important implications for the fields of positive psychology and adolescent development. First, the significant increases in positive thinking and character strengths indicate that the program may effectively enhance these positive traits among adolescents. This highlights the potential for implementing the program in schools, counselling centres, and NGOs to enhance overall well-being among the broader adolescent population in Hong Kong. Regularly conducting the group-based intervention may not only assist vulnerable adolescents in

developing positive traits but also improve social skills and foster a sense of belonging. By creating a supportive environment, these initiatives can empower young individuals to navigate challenges more effectively and contribute positively to their communities.

Second, the effectiveness of both CEO stories and positive cinema suggests that varied experiential learning methods can meet the diverse needs of adolescents. Counsellors, practitioners, and psychologists can leverage this flexibility to customize programs that better engage different groups. This approach makes positive psychology interventions more accessible and effective across various contexts, potentially leading to greater acceptance than traditional methods, such as lecture-style teaching of skills or strengths.

Third, the findings indicating that more sessions led to more significant enhancements in positive thinking highlight the importance of dosage in intervention design. Program developers should consider incorporating multiple sessions or increasing intensity to maximize benefits, ensuring that participants have ample opportunities to engage with the material and apply what they learn.

Fourth, the enhancement of character strengths following the intervention may equip adolescents with better coping mechanisms for managing life stressors. This suggests that integrating character strengths development into the school curricula could be beneficial for promoting overall psychological well-being among young people. The 24F program can create a customized learning path by offering different modules that cover all character strengths, allowing participants to selectively attend different intervention modules based on their personal weaknesses.

4.2. Limitations and Future Directions

This study is not without limitations. First, because positive thinking was assessed using a brief baseline form and an expanded post-intervention form, some observed change may reflect differences in measurement content. Future evaluations should administer the same item set across waves to maximise longitudinal comparability. Second, we only examined the effects of the intervention immediately following each activity and did not assess long-term changes. Future research should focus on long-term outcomes in positive thinking and character strengths using longitudinal or experience-sampling designs to better capture how the program fosters the development of positive traits over time.

Third, the study concentrated solely on the effects of the intervention on positive thinking and character strengths, neglecting to explore changes in well-being outcomes such as depressive and anxiety symptoms, stress levels, life satisfaction, and subjective well-being. Future research should investigate these psychological correlates to gain a more comprehensive understanding of the intervention's role in promoting overall well-being.

Fourth, our study assessed positive traits and intervention satisfaction using only quantitative measures. It may be beneficial for future research to incorporate qualitative methods (e.g., focus groups, interviews) to gain deeper insights into the specific aspects of the intervention that participants found most helpful, as well as their self-reflections on the traits they gained. By obtaining such richer insights, program developers can make necessary adjustments to enhance the overall effectiveness and impact of the intervention.

Fifth, our study involved a quai-experimental design in which the participants were not randomly assigned to the experimental or control groups. The lack of a controlled experiment may lead to confounding factors that may affect the outcomes of the study as the participants were aware of the group they were in, could communicate with participants in the group they were not in, and potentially learn the content of the 24F from others. As a result, the casual relationship between the intervention and observed changes in the targeted traits could not be established. Future researchers should conduct randomized controlled trials using a double-blinded design to increase the internal validity of the study and further examine the effect of the 24F program.

Lastly, our study did not examine the differential effects of the intervention across subgroups of

adolescents, such as those categorized by socioeconomic status, the presence of single-parent households, and pre-existing clinical symptoms. Future research should further investigate the extent to which the effects of the intervention vary based on the demographic characteristics of adolescents.

References

Baptist Oi Kwan Social Service. (2024, September 1). "2024 Secondary school students' well-being survey" well-being levels average, over half regularly engage in self-criticism, 20% require attention to mental health prosociality and family-school connections are key to happiness. https://www.bokss.org.hk/content/press/324/Press%20release_2024_Secondary_Student_Wellbeing_Survey.pdf

Benjamin, C. L., Puleo, C. M., Settipani, C. A., Brodman, D. M., Edmunds, J. M., Cummings, C. M., & Kendall, P. C. (2011). History of cognitive-behavioral therapy (CBT) in youth. *Child and Adolescent Psychiatric Clinics of North America*, *20*(2), 179–189. https://doi.org/10.1016/j.chc.2011.01.011

Blaine, J. (2024). Schools are in the future business: Exploring outcomes of a positive education programme for adolescents in Hong Kong. *Education Journal*, *13*(4), 199–210. https://doi.org/10.11648/j.edu.20241304.17

Bu, H., & Duan, W. (2018) A single-session positive cognitive intervention on first-year students' mental health: Short-term effectiveness and the mediating role of strengths knowledge. *Journal of American College Health*, *67*(6), 515–522. https://doi.org/10.1080/07448481.2018.1497639

Caprara, G. V., Alessandri, G., Eisenberg, N., Kupfer, A., Steca, P., Caprara, M. G., Yamaguchi, S., Fukuzawa, A., & Abela, J. (2012). The Positivity Scale. *Psychological Assessment, 24*(3), 701–712. https://doi.org/10.1037/a0026681

Chinese Young Men's Christian Association of Hong Kong. (2024, September 22). "*Secondary student mental health literacy" survey press conference* [Press conference session]. Hong Kong.

Cho, E. Y. N., & Chan, T. M. (2020). Children's wellbeing in a high-stakes testing environment: The case of Hong Kong. *Children and Youth Services Review*, *109*, 104694. https://doi.org/10.1016/j.childyouth.2019.104694

Chung, C. M. S. (2018). *Positive education in Hong Kong: Opportunities, challenges and recommendations for implementation*. [Master thesis, University of Pennsylvania]. University of Pennsylvania Repository. https://repository.upenn.edu/handle/20.500.14332/38818

Compton, S. N., March, J. S., Brent, D., Albano, A. M., Weersing, V. R., & Curry, J. (2004). Cognitive-behavioral psychotherapy for anxiety and depressive disorders in children and adolescents: An evidence-based medicine review. *Journal of the American Academy of Child & Adolescent Psychiatry*, *43*(8), 930–959. https://doi.org/10.1097/01.chi.0000127589.57468.bf

Fang, T. (2023). *Understanding the Prevalence and Consequences of Mental Health Disorders among Youths: A Focus on Secondary School Students in Hong Kong*. https://doi.org/10.21203/rs.3.rs-3503936/v2

Flückiger, C., Munder, T., Del Re, A. C., & Solomonov, N. (2023) Strength-based methods – a narrative review and comparative multilevel meta-analysis of positive interventions in clinical settings, *Psychotherapy Research*, *33*(7), 856–872. https://doi.org/10.1080/10503307.2023.2181718

Hjemdal, O., Friborg, O., Stiles, T. C., Martinussen, M., & Rosenvinge, J. H. (2006). A New Scale for Adolescent Resilience: Grasping the Central Protective Resources Behind Healthy Development. *Measurement and Evaluation in Counseling and Development*, *39*(2), 84–96. https://doi.org/10.1080/07481756.2006.11909791

Kendall, P. C., Peterman, J. S., & Cummings, C. M. (2015). Cognitive-behavioral therapy, behavioral therapy, and related treatments in children. In A. Thapar, D. S. Pine, J. F. Leckman, S. Scott, M. J. Snowling, & E. Taylor (Eds.), *Rutter's child and adolescent psychiatry* (pp. 496–509). John Wiley & Sons. https://doi.org/10.1002/9781118381953.ch38

Kolb, D. A. (2014). *Experiential learning: Experience as the source of learning and development*. FT press.

Kwak, S. G., & Kim, J. H. (2017). Central limit theorem: the cornerstone of modern statistics. *Korean Journal of Anesthesiology, 70*(2), 144–156. https://doi.org/10.4097/kjae.2017.70.2.144

Kwok, S. Y. C. L., Gu, M., & Tam, N. W. Y. (2022). A multiple component positive psychology intervention to reduce anxiety and increase happiness in adolescents: The mediating roles of gratitude and emotional intelligence. *Journal of Happiness Studies*, *23*(5), 2039–2058. https://doi.org/10.1007/s10902-021-00487-x

Lai, K. Y. C., Hung, S. F., Lee, H. W. S., & Leung, P. W. L. (2022). School-based mental health initiative: Potentials and challenges for child and adolescent mental health. *Frontiers in Psychiatry*, *13*, 866323. 66323. https://doi.org/10.3389/fpsyt.2022.866323

Low, Y. T., & Lee, K. W. (2024). Comparative outcomes of three school-based cognitive-behavioral interventions for adolescent suicide prevention in Hong Kong. *Healthcare*, 12(20), 2056. https://doi.org/10.3390/healthcare12202056

MacLeod, A. K., & Conway, C. (2007). Well-being and positive future thinking for the self versus others. *Cognition and Emotion, 21*(5), 1114–1124. https://doi.org/10.1080/02699930601109507

Martos Martínez, Á., Molero Jurado, M. d. M., Pérez-Fuentes, M. d. C., Barragán Martín, A. B., Simón Márquez, M. d. M., Tortosa Martínez, B. M., Sisto, M., & Gázquez Linares, J. J. (2021). Self-efficacy, positive future outlook and school burnout in Spanish adolescents. *Sustainability*, *13*(8), 4575. https://doi.org/10.3390/su13084575

Lerner, R. M., Almerigi, J. B., Theokas, C., & Lerner, J. V. (2005). Positive Youth Development A View of the Issues. *The Journal of Early Adolescence, 25*(1), 10–16. https://doi.org/10.1177/0272431604273211

Livingstone, K. M., & Srivastava, S. (2012). Up-regulating positive emotions in everyday life: Strategies, individual differences, and associations with positive emotion and well-being. *Journal of Research in Personality*, *46*(5), 504–516. https://doi.org/10.1016/j.jrp.2012.05.009

Niemiec, R. M. (2018). *Character strengths interventions: A field guide for practitioners.* Hogrefe Publishing.

Orchard, F., Pass, L., Chessell, C., Moody, A., Ellis, J., & Reynolds, S. (2020). Adapting brief CBT-I for depressed adolescents: A case illustration of the sleeping better program. *Cognitive and Behavioral Practice*, *27*(3), 336–346. https://doi.org/10.1016/j.cbpra.2019.07.010

Organisation for Economic Co-operation and Development (2023). *OECD digital education outlook 2023: Towards an effective digital education ecosystem*. OECD Publishing. https://doi.org/10.1787/c74f03de-en.

Park, N., & Peterson, C. (2006). Moral competence and character strengths among adolescents: The development and validation of the Values in Action Inventory of Strengths for Youth. *Journal of Adolescence*, *29*(6), 891–909. https://doi.org/10.1016/j.adolescence.2006.04.011

Park, N., & Peterson, C. (2009). Strengths of character in schools. In R. Gilman, E. S. Huebner, & M. Furlong (Eds.), *Handbook of positive psychology in schools* (pp. 65–76). Routledge. https://doi.org/10.4324/9780203884089

Park, N., Peterson, C., & Seligman, M. E. P. (2006). Character strengths in fifty-four nations and the fifty US states. *Journal of Positive Psychology*, *1*(3), 118–129. https://doi.org/10.1080/17439760600619567

Parker, K. R., Maki, A. W., & Harner, E. J. (1999). There is no need to be normal: Generalized linear models of natural variation. *Human and Ecological Risk Assessment: An International Journal*, *5*(2), 355–374. https://doi.org/10.1080/10807039991289482

Peterson, C., & Seligman, M. E. P. (2004). *Character strengths and virtues: A handbook and classification* (Vol. 1). Oxford university press.

Peterson, C., Ruch, W., Beermann, U., Park, N., & Seligman, M. E. P. (2007). Strengths of character, orientations to happiness, and life satisfaction. *Journal of Positive Psychology*, *2*(3), 149–156. https://doi.org/10.1080/17439760701228938

Pituch, K. A., & Stevens, J. P. (2015). *Applied multivariate statistics for the social sciences: Analyses with SAS and IBM's SPSS*. Routledge.

Quinlan, D., Swain, N., & Vella-Brodrick, D. A. (2011). Character strengths interventions: Building on what we know for improved outcomes. *Journal of Happiness Studies, 13*, 1145–1163. https://doi.org/10.1007/s10902-011-9311-5

Santilli, S., Ginevra, M. C., Sgaramella, T. M., Nota, L., Ferrari, L., & Soresi, S. (2015). Design My Future: An instrument to assess future orientation and resilience. *Journal of Career Assessment, 25*(2), 281-295. https://doi.org/10.1177/1069072715621524

Schoon, I., and Mortimer, J. (2017). Youth and the great recession: are values, achievement orientation and outlook to the future affected. *International Journal of Psychology, 52*, 1–8. https://doi.org/10.1002/ijop.12400

Schutte, N. S., & Malouff, J. M. (2019). The impact of signature character strengths interventions: A meta-analysis. *Journal of Happiness Studies, 20*(4), 1179-1196. https://doi.org/10.1007/s10902-018-9990-2

Schwarzer, R., & Jerusalem, M. (1995). *General Self-Efficacy Scale (GSE)* [Database record]. APA PsycTests. https://doi.org/10.1037/t00393-000

Seligman, M. E. P., Ernst, R. M., Gillham, J., Reivich, K., & Linkins, M. (2009). Positive education: Positive psychology and classroom interventions. *Oxford Review of Education, 35*(3), 293–311. https://doi.org/10.1080/03054980902934563

Seligman, M. E. P. (2011). *Flourish : a visionary new understanding of happiness and well-being*. Free Press.

Shane, J., and Heckhausen, J. (2016). It's only a dream if you wake up: Young adults' achievement expectations, opportunities, and meritocratic beliefs. *International Journal of Psychology, 52*, 40–48. https://doi.org/10.1002/ijop.12408

Shimai, S., & Urata, Y. (2023). Development and validation of the Character Strengths Test 24 (CST24): A brief measure of 24 character strengths. *BMC Psychology*, *11*(1), 238. https://doi.org/10.1186/s40359-023-01280-6

Shek, D. T. L., & Wong, T. T. Y. (2025). Developmental issues of university students in Hong Kong. In *Promoting holistic development in university students.* Springer. https://doi.org/10.1007/978-981-96-0251-3_3

Sin, N. L., & Lyubomirsky, S. (2009). Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: A practice-friendly meta-analysis. *Journal of Clinical Psychology*, *65*(5), 467–487. https://doi.org/10.1002/jclp.20593

Skinner, A. T., Çiftçi, L., Jones, S., Klotz, E., Ondrušková, T., Lansford, J. E., Alampay, L. P., Al-Hassan, S. M., Bacchini, D., Bornstein, M. H., Chang, L., Deater-Deckard, K., Di Giunta, L., Dodge, L. A., Gurdal, S., Liu, Q., Long, Q., Oburu, P., Pastorelli, C., ... Yotanyamaneewong, S. (2022). Adolescent positivity and future orientation, parental psychological control, and young adult internalising behaviours during COVID-19 in nine countries. *Social Sciences, 11*(2), 75. https://doi.org/10.3390/socsci11020075

Snyder, C. R., Harris, C., Anderson, J. R., Holleran, S. A., Irving, L. M., Sigmon, S. T., Yoshinobu, L., Gibb, J., Langelle, C., & Harney, P. (1991). The Will and the Ways: Development and Validation of an Individual-Differences Measure of Hope. *Journal of Personality and Social Psychology*, *60*(4), 570–585. https://doi.org/10.1037/0022-3514.60.4.570

Snyder, C. R., Hoza, B., Pelham, W. E., Rapoff, M., Ware, L., Danovsky, M., Highberger, L., Ribinstein, H., & Stahl, K. J. (1997). The development and validation of the Children's Hope Scale. *Journal of Pediatric Psychology*, *22*(3), 399–421. https://doi.org/10.1093/jpepsy/22.3.399

Tejada-Gallardo, C., Blasco-Belled, A., Torrelles-Nadal, C., & Alsinet, C. (2020). Effects of school-based multicomponent positive psychology interventions on well-being and distress in adolescents: A systematic review and meta-analysis. *Journal of Youth and Adolescence, 49*(10), 1943–1960. https://doi.org/10.1007/s10964-020-01289-9

Tsui, Y. Y. Y., & Cheng, C. (2021). Internet gaming disorder, risky online behaviour, and mental health in Hong Kong adolescents: the beneficial role of psychological resilience. *Frontiers in Psychiatry*, *12*, 722353. https://doi.org/10.3389/fpsyt.2021.722353

van Starrenburg, M. L. A., Kuijpers, R. C. W. M., Hutschemaekers, G. J. M., & Engels, R. C. M. E. (2013). Effectiveness and underlying mechanisms of a group-based cognitive behavioural therapy-based indicative prevention program for children with elevated anxiety levels. *BMC psychiatry*, *13*(1), 183. https://doi.org/10.1186/1471-244X-13-183

Waters, L. (2011). A review of school-based positive psychology interventions. *The Australian Educational and Developmental Psychologist*, *28*(2), 75–90. https://doi.org/10.1375/aedp.28.2.75

Wigfield, A., Rosenzweig, E. Q., & Eccles, J. S. (2017). Achievement values: Interactions, interventions, and future directions. In A. J. Elliot, C. S. Dweck, & D. S. Yeager (Eds.), *Handbook of competence and motivation: Theory and application* (2nd ed., pp. 116–134). Guilford Publications.

Wong, S. M. Y., Chen, E. Y. H., Suen, Y. N., Wong, C. S. M., Chang, W. C., Chan, S. K. W., McGorry, P. D., Morgan, C., van Os, J., McDaid, D., Jones, P. B., Lam, T. H., Lam, L. C. W., Lee, E. H. M., Tang, E. Y. H., Ip, C. H., Ho, W. W. K., McGhee, S. M., Sham, P. C., & Hui, C. L. M. (2023). Prevalence, time trends, and correlates of major depressive episode and other psychiatric conditions among young people amid major social unrest and COVID-19 in Hong Kong: a representative epidemiological study from 2019 to 2022. *The Lancet Regional Health–Western Pacific*, *40*, 100881. https://doi.org/10.1016/j.lanwpc.2023.100881

Wong, D. F. K., Kwok, S. Y. C. L., Low, Y. T., Man, K. W., & Ip, P. S. Y. (2018). Evaluating effectiveness of cognitive-behavior therapy for Hong Kong adolescents with anxiety problems. *Research on Social Work Practice*, *28*(5), 585–594. https://doi.org/10.1177/1049731516658351

Xu, Z., Huang, F., Koesters, M., & Ruesch, N. (2017). Challenging mental health related stigma in China: Systematic review and meta-analysis. II. Interventions among people with mental illness. *Psychiatry Research*, *255*, 457–464. https://doi.org/10.1016/j.psychres.2017.05.002

Yu, L., & Du, M. (2022). Social networking use, mental health, and quality of life of Hong Kong adolescents during the COVID-19 pandemic. *Frontiers in Public Health*, *10*, 1040169. https://doi.org/10.3389/fpubh.2022.1040169

Yuen, W. W. Y., Liu, L. L., & Tse, S. (2019). Adolescent Mental Health Problems in Hong Kong: A Critical Review on Prevalence, Psychosocial Correlates, and Prevention. *Journal of Adolescent Health*, *64*(6), S73–S85. https://doi.org/10.1016/j.jadohealth.2018.10.005

Zhou, Q., Chan, S. S. C., Stewart, S. M., Leung, C. S. C., Wan, A., & Lam, T. H. (2016). The effectiveness of positive psychology interventions in enhancing positive behaviors and family relationships in Hong Kong: A community-based participatory research project. *Journal of Positive Psychology*, *11*(1), 70–84. https://doi.org/10.1080/17439760.2015.1025421