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Do adolescents with high cognitive flexibility feel less lonely? A latent profile analysis of cognitive flexibility in adolescents

Büşra KÖKÇAM[1*] Zeliha TRAŞ[2] Merve AKKOL[3]

[1] Uşak University, Turkey

[2] Necmettin Erbakan University, Turkey

[3] Necmettin Erbakan University, Turkey

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ABSTRACT

Adolescence is a period when loneliness is salient. Loneliness, in turn, gives rise to maladaptive cognitions and interpersonal behaviors, perpetuating a cycle of increased loneliness. Studies suggest that cognitive flexibility—the ability to choose and employ a variety of alternative perspectives and solutions (i.e., coping strategies) in accordance with changing contextual demands—may significantly contribute to adaptive responding to loneliness. This study aimed to examine whether adolescents with different cognitive flexibility profiles varied in loneliness and coping strategies. Additionally, we investigated whether potential variables such as sex and sources of social support could predict these profiles. Participants included Turkish high school students (N=437, 57% male), aged 14-17 years (M=16.25, SD=0.92), who completed a self-report survey. The analysis revealed three profiles that differed both quantitatively and qualitatively. Although the profiles showed varied patterns on cognitive flexibility subscales (alternatives and control), we labeled them as high, moderate, and low cognitive flexibility based on their overall levels for simplicity. The results indicated that the members of HCF (high alternatives, high control) reported lower levels of loneliness and higher levels of approach coping strategies compared the MCF (moderate alternatives, low control) and the LCF (low alternatives, moderate control). Despite having low perceived control, the members of MCF often use approach strategies like problem-solving compared to LCF. Furthermore, the study found that sex and primary sources of social support were significant predictors of different profiles. The MCF profile was more common among females compared to the high cognitive flexibility (HCF) profile. Members of the LCF profile, as opposed to the HCF profile, more often reported peers and significant others as their primary social support, rather than family support. Our conclusion is that enhancing family support and cognitive flexibility can serve as preventive measures against loneliness and related issues in adolescents.

Bilişsel Esnekliği Yüksek Olan Ergenler Kendilerini Daha Az mı Yalnız Hissediyor? Ergenlerin Bilişsel Esnekliğine İlişkin Bir Latent Profil Analizi

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ÖZET

Ergenlik dönemi yalnızlığın belirgin olduğu bir gelişim dönemidir. Yalnızlık da uyumsuz bilişlere ve kişilerarası davranışlara yol açarak yalnızlığın arttığı bir döngüyü devam ettirir. Araştırmalar, değişen bağlamsal taleplere uygun olarak çeşitli alternatif bakış açıları ve çözümleri seçme ve kullanma yeteneği olarak tanımlanan bilişsel esnekliğin, yalnızlığa adaptif yanıt vermeye önemli ölçüde katkıda bulunabileceğini göstermektedir. Bu çalışmada, ergenlerin bilişsel esneklik profillerinin yalnızlık ve başa çıkma stratejileri açısından farklılık gösterip göstermediğini incelemek amaçlanmıştır. Ayrıca, cinsiyet ve sosyal destek kaynakları gibi potansiyel değişkenlerin profilleri anlamlı bir şekilde yordayıp yordamadığı incelenmiştir. Altı okuldan yaşları 14-17 arasında değişen ($\bar{x}$= 16.25, ss=0.92) 437 lise öğrencisi (%57 erkek) öz bildirime dayalı formu doldurmuştur. Latent profili analizi, hem niceliksel hem de niteliksel olarak farklılık gösteren üç profil ortaya çıkarmıştır. Profiller bilişsel esneklik alt ölçeklerinde (alternatifler ve kontrol) farklı örüntüler gösterse de, basitlik açısından genel bilişsel esneklik düzeylerini dikkate alarak yüksek, orta ve düşük olarak etiketledik. Sonuçlar, YBE (yüksek alternatifler, yüksek kontrol) üyelerinin OBE (orta alternatifler, düşük kontrol) ve DBE (düşük alternatifler, orta kontrol) üyelerine kıyasla daha düşük düzeyde yalnızlık bildirdiklerini göstermiştir. Sonuçlar, orta bilişsel esneklik profilindekilerin algılanan kontrol düzeyleri düşük olmasına rağmen, problem çözme de dahil olmak üzere yaklaşma türü başa çıkma stratejilerini düşük bilişsel esneklik profilindekilere göre daha sık kullandıklarını göstermektedir. Çalışma ayrıca cinsiyet ve birincil sosyal destek kaynaklarının farklı profillerin önemli belirleyicileri olduğunu ortaya koymuştur. OBE profili, yüksek bilişsel esneklik (YBE) profiline kıyasla kız öğrenciler arasında daha yaygındır. Düşük bilişsel esneklik profilindekiler, yüksek bilişsel esneklik profilindekilerle karşılaştırıldığında aileden çok akranlarını veya önemli diğerlerini birincil destek kaynağı olarak bildirmişlerdir. Sonuç olarak, aile desteğinin ve bilişsel esnekliğin artırılması, ergenlerde yalnızlık ve ilgili sorunlara karşı önleyici tedbirler olarak hizmet edebilir.

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Corresponding Author: Büşra KÖKÇAM, *busra.kokcam@usak.edu.tr*

INTRODUCTION

Adolescence is a crucial stage of development where peer interactions and relationships gain significant importance (Qualter et al., 2015; Ribeiro et al., 2023). Meanwhile, it is a period marked by an increased risk of experiencing feelings of loneliness (Majorano et al., 2015; Twenge et al., 2021). Adolescents must cope with substantial changes in social expectations and relationships, making them more susceptible to loneliness (Laursen & Hartl, 2013). They face conflicting developmental challenges, such as (a) forming new social networks and closer peer relationships, (b) reducing their reliance on their families while feeling supported by them, and (c) establishing their individuality, autonomy, and identity (Majorano et al., 2015). During this developmental period, being alone and engaging in solitary activities can be considered somewhat normal, offering opportunities for self-reflection and identity exploration (Laursen & Hartl, 2013; Qualter et al., 2015). However, spending a lot of time alone can lead to missed opportunities for interacting with peers, putting youths at risk for negative developmental outcomes (Wang et al., 2013). Vanhalst et al. (2012) found that loneliness and depressive symptoms were mutually influential over five years during adolescence. Chronic loneliness has been identified as a major risk factor for internalizing (i.e., social withdrawal, depression, anxiety, loneliness) and externalizing problems (i.e., substance and behavioral addictions), lower peer acceptance, and greater likelihood of being victimized in young people (Danneel et al., 2019; Heinrich & Gullone, 2006; Savolainen et al., 2020; Woodhouse et al., 2012). Loneliness leads to maladaptive cognition schemas (e.g., hypervigilance, low self-efficacy) and interpersonal behaviors (e.g., social withdrawal). Ultimately, these dysfunctional cognitive processes reinforce feelings of loneliness and stress (Park et al., 2020).

Studies addressing maladaptive social cognition indicate that cognitive flexibility may be a critical contributor to adaptive responding to loneliness (Masi et al., 2011). Cognitive flexibility refers to the ability to switch cognitive sets to adapt to changing contextual demands (Dennis & Van der Wal, 2010). It enables individuals to produce multiple alternative perspectives and solutions to difficult life situations. It also helps them see themselves as capable of coping with these situations. Coping is a dynamic process that encompasses cognitive, emotional, and behavioral strategies to stressful situations. The flexibility concept challenges the idea that certain strategies are inherently more beneficial than others. It emphasizes that successful responses are contingent on closely aligning cognitive, behavioral, and emotional strategies with the specific demands of a given situation. It is thus reflected in a vast repertoire of coping strategies, employed according to contextual demands (Kato, 2012).

The tripartite model of coping includes problem-focused strategies (i.e., attempts to modify the source of stress) and emotion-focused strategies (i.e., attempts to regulate the emotional distress caused by the stressor) and relationship-focused coping (i.e., maintaining close relationships). Problem-focused strategies are active in nature and oriented toward confronting the problem. Therefore, they are more likely to be employed when people perceive the situation as changeable and controllable. However, in stressful situations that cannot be changed, persistently engaging in problem-focused coping efforts may actually be maladaptive. Therefore, in such situations, people may need to direct their efforts toward emotion- or relationship-focused coping (Stephenson et al., 2016, p. 360). For example, in a longitudinal study that investigated the link between strategies in the tripartite model and levels of daily loneliness, problem-focused coping was associated with increased daily loneliness, whereas emotion-focused and relationship-focused coping strategies were associated with decreased daily loneliness (Wegner et al., 2022).

Emotion-focused strategies include avoidance, distancing, wishful thinking, as well as cognitive reappraisals, which involve changing the meaning of the situation without altering the external reality of that situation. Cognitive reappraisal is among the most effective coping strategies and is commonly

employed in cognitive-behavioral approaches (Stephenson et al., 2016). However, relying solely on cognitive reappraisal or other emotion-focused strategies have been associated with maladjustment. For example, Schoenmakers et al. (2012) and Deckx et al. (2018) found that emotion-focused coping was associated with increased loneliness. Beyond resolving the problem and regulating emotions, there exists a third significant dimension of coping: relationship-focused strategies. These strategies involve providing support, responding empathically, and attempting to resolve differences. In particular, social support falls within the category of relationship-focused strategies. The effects of social support on loneliness may depend on the relationship context (i.e., peers, family, or a romantic partner) in which the support is provided. Zhang and Dong (2022), in their meta-analysis study conducted on adolescents and adults, reported that peer support played a more important role in reducing loneliness than other types of supports (i.e., family, significant others).

Although previous findings imply a key role of cognitive flexibility in successfully coping with loneliness, there have been limited studies on this topic, and some of them are focused solely on adults. Research investigating the relationship between cognitive flexibility and loneliness has revealed that low flexibility is linked to more loneliness (Akdeniz & Ahçı, 2023; Curran, 2018; Özer, 2023; Patwardhan vd., 2021). Critically, no study to date has investigated the impact of cognitive flexibility on coping strategies along with loneliness in adolescents. Such an investigation seems warranted since cognitive flexibility is likely required for adaptive responding to loneliness as a result of developmental changes.

To further understand how cognitive flexibility facilitates in coping with loneliness, it is essential to delve into its components. Cognitive flexibility is broken down into two factors: Alternatives and Control. "Alternatives" denote an individual's capacity to generate various viewpoints and solutions when faced with a situation, while "Control" the perceived controllability of that situation. Individuals who feel more in control perceive the situation as more manageable (Dennis & Van der Wal, 2010). Conversely, those who feel incapable of controlling the situation tend to feel more helpless and threatened (Kim, 2003). This means that individuals who express a high level of control are more likely to perceive challenging tasks as opportunities to overcome, rather than as obstacles to be avoided. Consequently, they tend to employ adaptive various coping strategies, leading to reduced loneliness (e.g., improving social skills, increasing opportunities for social contact). Hence, examining adolescents' cognitive flexibility profiles in terms of coping strategies and loneliness is informative.

So far, only objective tests (e.g., Arithmetic Reasoning Test, Wisconsin Card Sorting Test) have been used to obtain cognitive flexibility profiles (e.g., Rathgeb-Schnierer & Green, 2017). Rathgeb-Schnierer and Green (2017) defined cognitive flexibility as the ability to choose the strategy that leads to the correct answers to mathematical problems in the fastest manner. They measured the degree of flexibility exhibited by primary school children in situations requiring mental arithmetic. By analyzing the reasoning behind the solutions using qualitative methods, they revealed cognitive flexibility profiles. While cognitive flexibility in mental arithmetic provides insight into a person's approach to life problems, it is quite specific and insufficient to fully understand a person's general cognitive flexibility. Furthermore, Miles et al. (2023) compared patients diagnosed with anorexia nervosa with healthy controls and found no significant difference in objective cognitive flexibility. However, they did report a significant difference in subjective cognitive flexibility. The researchers suggested that this discrepancy might stem from the low ecological validity of the objective test (i.e., Wisconsin Card Sorting Test). They noted that the abstract stimuli used in the WCST may not accurately reflect everyday executive functions, potentially leading to a disconnection between the test results and real-world cognitive flexibility. Also as Martin and Anderson (1998) pointed out, cognitive flexibility encompasses not just objective dimensions like recognizing alternatives but also subjective dimensions like the willingness to apply these alternatives and one's perceived level of control. While people might be aware

of several ways to response, this awareness does not necessarily restrain habitual responses in favor of more adaptive responses. Therefore, we used a self-report cognitive flexibility measurement tool in this study.

In light of these considerations, the objective of this study is to investigate self-reported cognitive flexibility profiles in adolescents concerning their experiences of loneliness and coping strategies. We explored different configural cognitive flexibility profiles of adolescents. We expected to find significant differences between these profiles in terms of loneliness and coping strategies. We further explored whether the profiles were significantly predicted by potential variables (e.g., socio-demographic factors and source of social support).

METHOD

During the spring 2022 in Turkiye, participants from six high schools were asked to complete measures of cognitive flexibility (Dennis & Van der Wal, 2010), coping strategies (Moos, 1993), and loneliness (Hays & DiMatteo, 1987) scales in the classroom. Based on these data, we conducted latent profile analyses to investigate the existence of discernable patterns of cognitive flexibility and their association with coping strategies and loneliness. Finally, we conducted multinomial logistic regression analyses to investigate which potential variables (e.g., socio-demographic factors and primary source of social support) uniquely predict different profiles.

Participants

A total of 437 participants (247 males; 57%), aged between 14 and 17 years (M = 16.25, SD = 0.92), were recruited from six high schools (grades 9 through 12) in a large city in Central Anatolia. The sample comprised 20 (4.6%) ninth-grade students, 148 (34.1%) tenth-grade students, 110 (25.35%) eleventh-grade students, and 159 (36.64%) twelfth-grade students.

Procedure

After obtaining permission from the university's ethics committee for the study, we obtained approval from the directorate of national education and school authorities, as well as written informed consent and assent from all participants. Data collection took place during regular school hours in the classroom, in a single 40-minute session. A research assistant was present to introduce the study and address any questions. In each classroom, students informed about the voluntary nature of participation. Personal data collection and processing followed APA Ethical Guidelines and complied with the Declaration of Helsinki, ensuring participants' privacy and confidentiality.

Measures

Cognitive Flexibility

The Cognitive Flexibility Inventory (CFI) developed by Dennis and Vander Wal (2010) consists of 20 items describing possible approaches to challenging. The inventory has two subscales: Control and Alternatives. The Control subscale assesses perceived control over stressful situations (i.e., “When I encounter difficult situations, I feel like I am losing control”); the Alternatives subscale assesses the ability to perceive alternatives to difficult situations (i.e., “I try to think about things from another person’s point of view”). While the original inventory was answered on a 7-point Likert scale, the Turkish version of CFI is answered on a 5-point Likert scale (1= ”Strongly disagree”, 3= ”Neutral”, 5= ”Strongly agree”). Sapmaz and Doğan (2010), who conducted a validity and reliability study of the Turkish version of CFI, reported Cronbach’s α of .90 for the total CFI, .90 for the Alternatives subscale, and .84 for the Control subscale. They reported test–retest reliability after two weeks was high for the total CFI score (r =.75) and for both the Alternatives (r = .78) and Control (r = .73) subscales (*p*s < .001). The Turkish version of the CFI has good structural validity (RMSEA=.05, CFI= .98) (Sapmaz & Doğan,

2010).

Coping Strategies

The Coping Responses Inventory (CRI) was developed by Moos in 1993 and consists of 48 items measured on a 6-point Likert scale (1="not at all" to 6="fairly often"). The inventory is based on a multidimensional model that emphasizes the focus and method of coping. The focus of coping refers to the individual's orientation toward the problem (approach versus avoidance) and method refers to cognitive and behavioral efforts that individuals make to manage or resolve stressors. These two dimensions (focus and method) combine to create four response categories. Each category encompasses two specific strategies: cognitive approach coping (logical analysis and positive reappraisal), behavioral approach coping (seeking guidance and problem-solving), cognitive avoidance coping (cognitive avoidance and acceptance/resignation), and behavioral avoidance coping (seeking alternative rewards and emotional discharge) (Kirchner et al., 2008). Koca- Ballı and Kılıç (2016) adapted the approach orientation of the inventory into Turkish. The Turkish version of the scale consisted of 22 items measured on a 5-point Likert scale (1="Never" to 5="Always"), and Cronbach's α was .93 for the total, ranging from .91 to .73 for the categories. The Turkish version of the CRI has adequate structural validity (RMSEA=.07, CFI= .93) (Koca-Ballı & Kılıç, 2016).

Loneliness

The original UCLA Loneliness Scale, a 20-item scale, developed by Russell et al. (1978) to measure loneliness (i.e., "I feel isolated from others"), was shortened to 8 items by Hays and DiMatteo (1987). Yıldız and Duy (2014) obtained a seven-item Turkish version of the scale in an adaptation study of ULS-8 on adolescents. These statements are rated on a 4-point-scale (1 = "Never" to 4 = "Always"). They reported that Cronbach's α of .74 for the scale, test– retest reliability after two weeks was high for the scale ($r=.84$, $p < .001$). The Turkish version of ULS-8 has good structural validity (RMSEA=.06, CFI= .98) (Yıldız & Duy, 2014).

Potential Variables

We used multinomial logistic regression analysis to investigate how age, gender, and the primary source of emotional support, which are potential predictors of cognitive flexibility profiles, influence the outcome. It is anticipated that cognitive flexibility during adolescence will increase with age (Kupis et al., 2021). However, whether or not sex differences in cognitive flexibility do exist remains unclear, because the results of previous studies are contradictory and there are inconsistencies in the literature. Some researchers claim that females had higher levels of cognitive flexibility (Esen–Aygun, 2018; Patwardhan vd., 2021) whereas others claim that males had higher levels of cognitive flexibility (Roothman, 2003), and still there are others reporting no sex differences in cognitive flexibility (Erarslan, 2023; Çelikkaleli, 2014). We conducted an exploratory examination to determine whether sex predicts cognitive flexibility profiles.

In the developmental stage of adolescence, friends gradually replace family as a source of social support (Scholte et al., 2001). Zhang and Dong (2022) found that peer support was more effective in reducing loneliness than other types of support (i.e., family, significant others). Burton et al. (2004) revealed that low levels of perceived peer support, but not perceived family support, were significantly associated with subsequent increases in depressive symptoms among adolescent girls. However, Helsen et al. (2000) found that greater perceptions of family support were associated with less emotional issues during adolescence, whereas no significant association was found for perceived peer support. Contradictory findings in the literature regarding the relationship between social support sources and loneliness prompted an exploratory examination of the primary source of social support and its potential impact on loneliness within cognitive flexibility profiles. The primary source of social support was

assessed by asking individuals, 'From whom do you receive the most support when you encounter a problem?' The response options included family, friends, and significant others.

Data Analysis

To explore the existence of different cognitive flexibility profiles, we conducted latent profile analyses (LPA). LPA, a mixture modeling technique, offers a more nuanced understanding of a population by uncovering its inherent diversity. It employs mixture models to provide a more accurate representation of the relationships within the data. This approach departs from the assumption that relationships are uniform for all individuals in a population and acknowledges that relationships can vary across different subgroups (Nylund-Gibson et al., 2014). LPA models offer an advantage by not depending on typical modeling assumptions, which are frequently violated in practical situations, including assumptions of linear relationships, normal distributions, and homogeneity. Consequently, they are more robust to biases that may result from data not aligning with these modeling assumptions. Furthermore, rather than employing traditional cluster analysis methods that group cases based on proximity using ad hoc distance measures through 'unsupervised' learning or classification algorithms, we opted for latent class analysis. In this approach, cases are grouped based on directly estimated membership probabilities derived from the model using maximum likelihood estimation (Magidson & Vermunt, 2002).

The process of conducting LPA/LCA is an iterative, stepwise procedure that resembles exploratory factor analysis. It comprises four discernible steps, with the last one being discretionary: (i) specifying the model, (ii) determining the number of latent classes, (iii) providing substantive interpretation to the final solution, and (iv) incorporating predictors and/or outcomes related to latent class membership (Bauer, 2022).

Specifying the model involves making decisions about which indicators should be included in the LPA measurement model and whether any restrictions should be imposed on the model parameters. The items in the Cognitive Flexibility Inventory serve as indicators in our LPA model. Determining the appropriate number of classes is often the most challenging step in the entire analysis. The aim is to find a solution that maintains a balance between model simplicity and fit while resulting in classes that have substantive interpretability. To accomplish this, a range of models, starting from 1 up to k latent classes, is estimated and then assessed through a comparison of their relative model fit and classification diagnostics. The most frequently employed fit indices include the Bayesian Information Criterion (BIC), its sample-size-adjusted version (SABIC), and the Akaike Information Criterion (AIC). In the case of these and other information criteria, lower values indicate a better model fit. Besides relying on information criteria, models with adjacent numbers of latent classes can be compared by a likelihood ratio test (LRT), which comes in several versions, such as the bootstrapped likelihood ratio test (BLRT). If the (B)LRT produces a statistically significant outcome, it favors the model with k classes over the one with k-1 classes (Bauer, 2022; Nylund et al., 2007).

Classification diagnostics can provide further insights into the class enumeration procedure. For each latent class, the 'Average Posterior Class Probabilities' (AvePPk) offer an assessment of classification accuracy. These values are calculated by averaging the model-estimated (posterior) probabilities of latent class membership for individuals whose highest membership probability is in this class. It is suggested that values greater than or equal to .70 are considered desirable (Masyn, 2013). Another important classification diagnostic is the entropy index, which indicates how accurately individuals are classified in the model and functions similarly to the reliability coefficient in the model, taking values between 0 and 1, where 1 is perfect classification and values approaching 1 indicate distinct and clear separation of classes (Celeux & Soromenho, 1996). Classification accuracy may be useful to decide between solutions that have similar fit (Bauer, 2022), but note that not used for model

fit because it is a measure that delineates the overall classification of individuals into the latent classes assuming the model is correct and is not intended for model selection (Nylund et al., 2014).

For the interpretation process in LPA, it is essential to examine class-specific mean/probability profiles across indicators and differences between classes. The class profiles should be discernibly different from one another. This analysis helps define and label each class, while also considering class sizes to distinguish common or normative profiles from more exceptional ones. Solutions that lack interpretability should not be retained, regardless of their model fit (Bauer, 2022). Solutions with several small classes (typically ≤ 5%) may indicate an excessive number of extracted classes, and it's crucial to critically assess whether these small classes have distinct and interpretable profiles (Nylund et al., 2007).

LPAs were conducted in R (R Core Team, 2021; version 4.1.0) and Rstudio (version 1.4.1106). In this study, we opted for the 'mclust' (Scrucca et al., 2016) and 'tidyLPA' (Rosenberg et al., 2018) packages, which are widely employed in latent profile analysis. In all LPA models, the means and the variances of the profile indicators in each latent class were estimated freely. The covariances among indicators within the latent classes were fixed to zero in all models. To describe profiles, we compared subscales across and within classes. We also investigated differences between cognitive flexibility profiles in coping strategies and loneliness. The effect sizes of the differences between the profiles were calculated using the 'MOTE' (Buchanan et al., 2019) and 'compute.es' package (Del Re, 2013). Finally, we investigated the impact of potential variables (i.e., age, sex, primary source of social support) on latent class membership using multinomial logistic regression with the 'mlogit' package (Croissant, 2020).

RESULTS

Descriptive statistics, internal consistency of the scales (Cronbach's alpha), correlations between the coping responses (i.e., approach orientation) and its four categories, cognitive flexibility, and its two factors, loneliness are presented in Table 1.

Table 1

Correlation matrix and descriptive statistics of the study variables

	1	2	3	4	5	6	7	8	9
1 **Total approach coping**	—	.82	.82	.85	.70	.57	.60	.18	-.13
2 Logical analysis	<.001	—	.55	.66	.39	.54	.59	.15	-.07
3 Positive reappraisal	<.001	<.001	—	.58	.46	.42	.41	.19	.10
4 Problem solving	<.001	<.001	<.001	—	.46	.57	.58	.22	-.17
5 Seeking guidance	<.001	<.001	<.001	<.001	—	.27	.34	.01	-.08
6 **Total cognitive flexibility**	<.001	<.001	<.001	<.001	<.001	—	.88	.63	-.23
7 Alternatives	<.001	<.001	<.001	<.001	<.001	<.001	—	.19	-.12
8 Control	<.001	.001	<.001	<.001	.908	<.001	< .001	—	-.29
9 **Loneliness**	.007	.174	.047	<.001	.096	<.001	.015	< .001	—
M	3.35	3.66	3.39	3.38	2.53	3.41	3.57	3.10	2.18
SD	0.58	0.71	0.77	0.76	0.96	0.59	0.27	0.83	0.68
α	.86	.70	.70	.73	.60	.83	.86	.74	.72

Note. Values in the top right are correlation coefficients, bottom left are p-values.

Coping responses were highly positively associated with cognitive flexibility. Specifically, two types of approach coping responses (i.e., logical analysis and problem solving) were strongly positively correlated with alternatives, and positive reappraisal was moderately correlated with alternatives. Seeking guidance was moderately correlated with alternatives. Alternatives and control were highly positively related to cognitive flexibility, but were weakly related to each other. Loneliness was weakly negatively correlated with both cognitive flexibility, positive reappraisal, and problem solving. Control

and coping responses (except seeking guidance) were weakly positively correlated with each other. Also, logical analysis and seeking guidance were not correlated with loneliness.

Table 2

Fit indices and entropy index by latent class/profile models

Model	LL	AIC	AWE	BIC	CAIC	SABIC	BLRT	p_{BLRT}	Entropy
1	-6097.37	12274.74	12799.13	12437.93	12477.93	12310.99	-	-	1.00
2	-5513.63	11149.26	11950.27	11398.14	11459.14	11204.55	1167.48	0.01	0.87
3	-5333.49	10830.98	11908.23	11165.53	11247.53	10905.31	360.28	0.01	0.93
4	-5284.19	10774.39	12128.06	11194.62	11297.62	10867.75	98.59	0.01	0.90

Abbreviations: LL=Log Likelihood; AIC= Akaike Information Criterion; AWE= Approximate Weight of Evidence; BIC=Bayesian Information Criterion; CAIC = Consistent Akaike Information Criterion; SABIC=Sample-Size Adjusted Bayesian Information Criterion; BLRT = Bootstrapped Likelihood Ratio Test; p_{BLRT}= p-value of the BLRT.

We began with the one-class model and increased the number of classes until nonconvergence was achieved. Upon encountering nonconvergence starting from the five-class model, we analyzed the available solutions to determine the optimal number of classes. The BLRT value did not play a role in model selection, as it consistently yielded significant results in all k-class and k-1-class comparisons. While the AIC and SABIC values favored a four-class model, their utility in model selection was limited, as we lacked a five-class solution for comparison. The AWE, BIC, and CAIC values favored a three-class model. Moreover, the entropy value, a summary of classification accuracy, was higher in the three-class model than in the four-class model (see Table 2). Another classification diagnostic, the Average Posterior Class Probabilities (AvePPk), indicates that individuals are classified with high classification accuracy in the three-class model (see Table 3). Taking into account the principles of parsimony and the meaningful interpretation of classification, we determined that the three-class model is the most suitable fit for the data.

Table 3

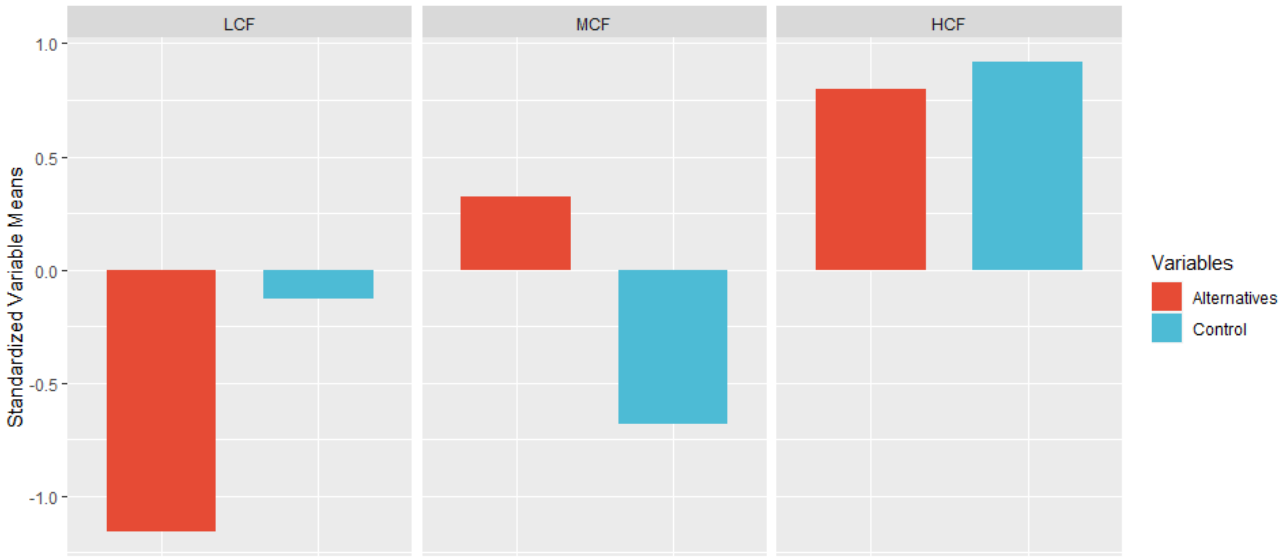
Descriptives and average posterior class probability for the three-class model

	Latent class/profile			*n* (%)	n_{sex} (%)	
	Class 1	Class 2	Class 3		Female	Male
Class 1	**.95**	.03	.02	140 (32)	59 (31)	81 (33)
Class 2	.03	**.97**	<.01	160 (37)	84 (44)	76 (31)
Class 3	<.01	<.01	**.99**	137 (31)	47 (25)	90 (36)

Note. Average posterior probabilities represent the probability that an individual belongs to the respective assigned class. The bold values highlight the correct classification.

Figure 1

Bar plot of the z-scores for the three-class model based on cognitive flexibility



Abbreviations: LCF: Low Cognitive Flexibility; MCF: Moderate Cognitive Flexibility; HCF: High Cognitive Flexibility.

Class 1, comprising of 35% of the entire sample, has the lowest level of Alternatives and moderate level of Control. This class was named as 'Low Cognitive Flexibility (LCF)' because it represented individuals who had low ability to perceive alternatives to difficult situations. Class 2 included 38% of the participants, whose Alternatives level was moderate and Control level was low. This class was named as 'Moderate Cognitive Flexibility (MCF)'. Class 3 represented 27% of the participants. This class was named as 'High Cognitive Flexibility (HCF)' because individuals in this class had very high levels of alternatives and control (see Figure 1).

Table 4

Study variables by latent profiles

Variable	P1: LCF		P2: MCF		P3: HCF		ANOVA (2, 434)		Differences between profiles ($p < 0.001$)
	M	*SD*	*M*	*SD*	*M*	*SD*	*F*	ω^2	
Alternatives	36.29	7.05	49.41	5.38	53.55	5.74	308.6	0.58	P3>P2>P1
Control[a]	20.82	5.36	18.20	3.65	26.77	4.05	182.4	0.45	P3>P1>P2
Logical analysis	19.30	4.21	22.39	3.65	24.34	3.27	64.38	0.22	P3>P2>P1
Positive reappraisal	18.59	4.51	20.24	4.25	22.23	4.40	24.05	0.10	P3>P2>P1
Problem solving	18.11	4.21	21.20	3.87	23.24	3.88	58.44	0.21	P3>P2>P1
Seeking Guidance	15.94	3.96	17.86	3.76	18.16	3.71	14.09	0.06	P3,P2>P1
Loneliness[a]	15.78	4.89	15.97	4.97	13.77	3.94	11.49	0.05	P1,P2>P3

Note. [a]Since the assumption of homogeneity of variance between groups was not met, Welch's F was calculated. Significant differences by class corrected using the Benjamini-Hochberg false discovery rate controlling method.

Table 4 displays the differences in coping strategies, cognitive flexibility, and loneliness between profiles. The effect size of the differences between the profiles ranges from moderate to large (ω^2 =0.06 to 0.58). The ability of the profiles to perceive alternatives to difficult situations was parallel with their cognitive flexibility, but surprisingly, members of the LCF profile felt more in control than members of

the MCF profile. The frequency of using approach strategies is parallel to the cognitive flexibility of the profiles. Members of the HCF were reported feeling less lonely than other profiles. While a general difference in loneliness between the profiles was observed with a small effect size, pairwise comparisons revealed that the effect sizes of the differences between HCF and LCF (d=0.45) and between HCF and MCF (d=0.49) were moderate.

Table 5

Profiles based on demographic variables and primary source of social support

	LCF			MCF		
Predictor	**B**	**OR**	**95%**	**B**	**OR**	**95%**
Age	-0.20	0.82	0.63–1.07	0.05	1.05	0.80–1.37
Sex	0.27	1.31	0.79–2.18	0.78**	2.18	1.35–3.53
Peer support	0.81**	2.24	1.28–3.91	0.48	1.61	0.94–2.79
Significant other support	0.74*	2.09	1.10–3.99	0.41	1.51	0.80–2.87

Note. OR refers to odds ratio. The reference category for cognitive flexibility profiles is the High Cognitive Flexibility profile, and the reference category for the primary source of social support is family. * $p < 0.05$; **$p < 0.01$.

Table 5 reveals significant effects of sex and primary source of social support to estimate class membership. Members of the moderate cognitive flexibility (MCF) profile were more likely to be female. Finally, members of the low cognitive flexibility (LCF) profile were more likely to report peer or significant other support as their primary source of support (vs. family support).

DISCUSSION, CONCLUSION & SUGGESTIONS

The current study aimed to investigate self-reported cognitive flexibility profiles in adolescents concerning their experiences of loneliness and coping strategies. Analyses revealed three distinct cognitive flexibility profiles. The three profiles differed in the consideration of alternatives and perceived control. As the cognitive flexibility levels of the profiles increased, their willingness to look at events/situations from different perspectives also increased, whereas the same pattern did not hold for perceived control. Members of the high cognitive flexibility (HCF) profile reported a high sense of control compared to the other profiles, while surprisingly, members of the moderate cognitive flexibility (MCF) profile had a lower level of control than members of the low cognitive flexibility (LCF) profile. Why did adolescents in the moderate cognitive flexibility (MCF) profile report low levels of control (i.e., self-efficacy)? According to Choi (2004), there are sex role group differences in general self-efficacy perception, masculinity play a key role in the differentiation of individuals in self-efficacy. Given that members of the MCF are more likely to be female compared to members of the HCF, we can glean insights into the situation. This was corroborated by a large literature that suggested that that women tend to have a lower perception of control compared to men (e.g., Ross & Mirowsky, 2002; Sherman et al., 1997; Specht et al., 2013). According to Hagan et al.'s (1988) power control theory, girls are typically under more supervision than boys. Feminist sociologist and psychoanalyst Nancy Chodorow (1978) suggested that mothers tend to identify more with their daughters and help them differentiate less. As a result, the processes of separation and individuation are more difficult for girls. On the other hand, boys are encouraged to separate and individuate their experiences from the mother.

Sadowski and his colleagues (1983) proposed that females lack the same independence opportunities as males, leading them to rely more on influencing their parents to achieve their goals; thus, issues of social power and influence are more important for females than males. However, there is a tendency to give more opportunities to females, especially those living in higher-SES (socioeconomic status) homes. This suggests that female members of HCF may also be living in higher-SES households.

Bronfenbrenner (1958, p. 420) concluded that "parent–child relationships in the middle-class are consistently reported as more acceptant and equalitarian, while those in the working-class are oriented toward maintaining order and obedience." Research showed that lower-SES parents granted their children less autonomy, were less equalitarian, less cooperative, more restrictive, and more punitive and intrusive than higher-SES parents (Bayley & Schaefer, 1960; Woodworth et al., 1996). Higher-SES parent positively influences the level of perceived control by encouraging the child to take more initiative and think independently (Hoff & Laursen, 2019; Kraus et al., 2012). High perceived control (i.e., self-efficacy) facilitates adaptive behavior and helps constructive behavior change (Bandura, 1986). The crosscheck study by Freire et al. (2020) showed that university students who frequently use various approach-type coping strategies (i.e., positive reappraisal, support seeking, planning) report higher levels of self-efficacy than students who predominantly use only one type of strategy or who rarely use approach-type coping strategies.

In contrast to the results reported by Freire et al. (2020), the current study found that members of the MCF, despite having a lower level of control than members of the LCF, tended to employ approach-type coping strategies more frequently. Remarkably, members of the MCF reported a higher frequency of using problem-solving strategies categorized as active approaches. This finding is unexpected, given that perceived control and problem-solving strategies are typically positively related (Lazarus & Folkman, 1984). However, at the same time, Freire et al. report that men with the same coping profile have higher levels of self-efficacy than women. This finding suggests that females may use approach-type coping strategies with similar frequency but still have lower self-efficacy compared to males. Therefore, it is evident that the primary aspect of cognitive flexibility is generating "cognitive sets" suitable for the "characteristics of the context," essentially involving consideration of alternatives. Control, on the other hand, serves as a catalyst facilitating the emergence of the appropriate "response" to these cognitive sets. Thus, the willingness of MCF members to consider different alternatives enables them to resort to these responses more frequently than LCF members who rarely consider different alternatives, even if their level of control is lower than that of LCF members.

Members of the MCF profile, despite resorting more frequently to different approach-type coping strategies than members of the LCF, had similar levels of loneliness to LCF. Furthermore, even though they employed seeking guidance strategies (i.e., relationship-focused strategies) at similar levels to members of the HCF, they still experienced more loneliness than the HCF. The impact of relational support on loneliness could be contingent on the relationship context (i.e., peers, family, or a romantic partner) in which the support is provided. Extensive literature suggests that peer support plays a more significant role in alleviating loneliness for both adolescents and adults compared to other forms of support, such as family or significant others (Lee & Goldstein, 2016; Zhang & Dong, 2022). However, members of the LCF profile, compared to members of the HCF, more frequently identified friends and significant others as their primary sources of social support. Additionally, members of the MCF profile reported friends as their primary sources of social support, showing marginal significance. In a longitudinal study exploring the impact of social support sources on depression, Pössel et al. (2018) found that while friend support did not contribute meaningfully to depressive symptoms throughout adolescence, support from family reduced the negative effect of stress on depressive symptoms (see also, Helsen et al., 2000). The results indicate that, alongside having a diverse coping repertoire, family support plays a significant role in decreasing adolescents' levels of internalizing problems such as loneliness and depressive symptoms.

The relationship between peer support and internalizing-externalizing problems involves intricate mechanisms. Schwartz-Mette et al. (2020) found that peer support, has small, but consistent, negative associations with depressive symptoms. Another study suggested that strong peer support was associated with lower depressive symptoms only when family support was low. In contrast, strong peer support

was linked to an increase in depressive symptoms for adolescents with high levels of family support (Barrera & Garrison-Jones, 1992). Interestingly, some other research has presented contrasting results, indicating that supportive peer relationships were associated with lower depressive symptoms only when family conflict was low (Ciairano et al., 2007). Wills et al. (2004) proposed that the inconsistent effects of peer support may stem from peer relationships that emphasize social activities with a positive hedonic tone, encouraging spontaneous, and sometimes impulsive behaviors. On the other hand, parental relationships are more focused on goal-oriented and controlled behaviors. Hence, family support was found to have positive associations with protective factors, such as good self-control, and negative associations with risk factors. In contrast, peer support showed positive associations with protective factors but lacked consistent negative associations with various risk factors; in some cases, it even demonstrated positive relationships. For instance, Wills et al. (2004) found that family support was negatively related to substance use, whereas peer support was positively related to substance use.

Indeed, family support emerges as a pivotal factor in fostering adolescents' coping self-efficacy and self-control. Parents can help children to increase their coping repertoire by teaching various approach-type coping strategies appropriate to the challenging situation through modeling. Also, parents can significantly contribute to their child's development of self-efficacy and self-control by providing encouragement and support, motivating the child to persist in their efforts when dealing with challenging situations. This support and encouragement from parents can facilitate adolescents in coping more flexibly with challenges in all areas of life. This study underscores the foundational role of family support for adolescents, emphasizing that the absence of this foundation makes it challenging to replace with support from friends or significant others. This was corroborated by a study that found a high level of parental support enhanced the positive effect of high friendship support on reducing loneliness, whereas high friendship support compensated for the negative effect of a low level of parental support (Tian et al., 2012).

Despite our promising findings, this study has several limitations. One limitation of this study is that cognitive flexibility profiles were not cross validated. Future studies should explore the reproducibility of cognitive flexibility profiles. Another limitation of this study is that we focused on only an internalizing problem (i.e., loneliness). While loneliness is related to some other internalizing and externalizing problems, assessing cognitive flexibility profiles concerning these problems independently can inform tailored interventions for each profile. For instance, members of the MCF profile contemplate diverse alternatives but exhibit low control levels suggesting a susceptibility to anxiety. On the other hand, members of the LCF profile, with limited consideration of alternatives and low control, may be predisposed to externalizing problems. Even though both profiles report similar levels of loneliness, the nature of challenges faced by both profiles could vary.

Despite these limitations, the findings of our study have significant implications for preventive psychological counseling services. The fact that cognitive flexibility and family support are associated with lower levels of loneliness in adolescents suggests the importance of enhancing adolescents' cognitive flexibility skills and supporting them through proximal processes, such as parenting support programs may be important for building resilience to various challenges, including loneliness. Parenting support programs aim to enhance parental knowledge and empower caregivers with new skills, enabling them to provide effective care for their children, ultimately positively impacting their well-being. As different developmental priorities emerge during adolescence, parents need to be flexible enough to adapt their styles to these changes (Skeen et al., 2023). For example, in the parent-adolescent relationship, the behaviors of adolescents and parents are important in reducing conflicts and reestablishing closeness in the usual conflicts that arise due to parental authority and adolescents' increasing need for autonomy. In these programs, parents and adolescents can be encouraged to express their different feelings in conflict and thus find alternative interaction patterns and renegotiate their

relationship (Branje, 2018). Utilizing cultural adaptation of existing interventions, such as the Strengthening Families Program (Annan et al., 2017), Active Parenting of Teens (Foley et al., 2019), Alternatives for Families: A Cognitive-Behavioral Therapy (Jackson et al., 2019), Collaborative Problem Solving (Pollastri et al., 2019), and Family Check-Up (Connell et al., 2021), may hold promise as potential strategies for preventing internalizing and externalizing problems in adolescents.

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