



Online Self-Disclosure and Self-Concept Clarity Among Chinese Middle School Students: A Longitudinal Study

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Abstract

The relationship between online self-disclosure and self-concept clarity has been previously examined through cross-sectional studies. This study examined causal connections between online self-disclosure and self-concept clarity among Chinese middle school students using longitudinal data collected over 18 months. Participants were 535 seventh-grade students aged 12–14 years ($M_{\text{age}} = 12.93$, $SD = 0.54$, 43.18% girls), assessed four times, six months apart. In a random intercept cross-lagged panel model, self-concept clarity significantly predicted online self-disclosure. Latent growth mixture modeling identified two distinct growth trajectories for both online self-disclosure (Rapid change, 7%; Slow change, 93%) and self-concept clarity (Rapid change, 8%; No change, 92%). Multiple logistic regression analysis suggested that changes in self-concept clarity influenced the developmental trajectory profile of online self-disclosure. Although male and female students differed in online self-disclosure and self-concept clarity, gender differences in the developmental trajectory profiles of online self-disclosure and self-concept clarity were not significant. Supporting adolescents in developing a clear self-concept to mitigate risks associated with excessive online self-disclosure is important.

Keywords Online self-disclosure · Middle school students · Self-concept clarity · Developmental trajectory profile · Random intercept cross-lagged path model

Introduction

Online self-disclosure, a significant predictor of social networking addiction, profoundly affects adolescents' physical and mental health development (Chu et al., 2023; Lee, 2019). Research indicates that self-concept clarity influences online self-disclosure, with adolescents harboring an unclear self-concept being more likely to engage in frequent online self-disclosure and present multiple versions of themselves (Fullwood et al., 2016; Strimbu & O'Connell, 2019). Conversely, prior research has indicated that online self-disclosure influences self-concept clarity. Online self-disclosure fragments individuals' self-concept cognition, thereby diminishing the clarity of one's self-concept (Mann & Blumberg, 2022; Valkenburg & Peter, 2011). These associations have primarily been inferred from cross-

sectional data. This study investigated the causal relationship between online self-disclosure and self-concept clarity among middle school students using longitudinal data collected at four time points, employing a random intercept cross-lagged path model (RI-CLPM). Additionally, the development and changes in online self-disclosure and self-concept clarity among Chinese middle school students remain unknown. In this study, latent growth mixture modeling (LGMM) analysis was used to explore the developmental trajectory profile of online self-disclosure and self-concept clarity. The causal mechanisms were further elucidated by conducting multiple logistic regression analysis to assess the impact of antecedent variables on the developmental trajectory profile of the outcome variables.

Bidirectional Relationship Between Self-Concept Clarity and Online Self-Disclosure

With the development and popularization of social media, self-disclosure and communication have become more convenient, and online self-disclosure has become a universal social behavior. Online self-disclosure refers to sharing personal information on social networking

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platforms (Dhir, 2017). According to the China Internet Network Information Center, as of June 2022, there were 1.01 billion Chinese internet users, spending an average of 29.5 hours online per week (Center, 2022). Platforms such as QQ, WeChat, and microblogs have become the most widely used online self-disclosure tools among Chinese teenagers. However, research shows that online self-disclosure predicts social networking addiction (Lee, 2019). Notably, online self-disclosure may lead to a network disinhibition effect that weakens individuals' behavioral constraints and subsequently contributes to cyberbullying and related phenomena (Aizenkot, 2020; Joinson, 2007). Research has also linked online self-disclosure to depression and problematic sleep among students (Dhir et al., 2021; Piko et al., 2022). In addition, online self-disclosure can trigger social comparisons leading to jealousy, which negatively affects mental health and social adaptation (Caiyu et al., 2022).

Research has shown that adolescents with unclear self-concepts are more likely to use social networks excessively (Israelashvili et al., 2012). Self-concept refers to an individual's self-awareness, which is influenced by their experiences and perceptions of their environment (Marsh & Shavelson, 1985). Self-concept clarity signifies the degree to which individuals possess a clear understanding of the consistency, confidence, and stability of their self-concepts (Campbell et al., 1996). Studies on the relationship between self-concept clarity and online self-disclosure have yielded conflicting findings.

One perspective suggests that self-concept clarity influences online self-disclosure. Studies have indicated that adolescents with unclear self-concepts tend to engage in more online self-disclosure and project multiple versions of themselves (Fullwood et al., 2016). Additionally, research has shown that self-concept clarity significantly predicts online self-disclosure. This may occur because individuals with low self-concept experience a greater discrepancy between their offline and online selves, leading to increased online self-disclosure (Strimbu & O'Connell, 2019). Establishing a sense of self-identity is crucial during adolescence. The online realm, particularly social media, serves as a platform through which young individuals can cultivate and express various aspects of their identities. According to self-identity theory, adolescents with low self-concept clarity are predisposed to self-identity confusion and uncertainty, which drives them to engage in online self-disclosure to seek identity and fulfill their psychological needs (Hsieh et al., 2019; Marcia, 1966; Stets & Burke, 2000).

Another perspective is that online self-disclosure affects adolescents' self-concept clarity. The self-concept fragmentation hypothesis proposes that online self-disclosure may fragment an individual's awareness of their self-concept, consequently reducing self-concept clarity (Valkenburg & Peter, 2011). That is, online self-disclosure negatively predicts

self-concept clarity. Furthermore, one study suggested that adolescents' online self-disclosure is detrimental to developing a clearer self-concept (Mann & Blumberg, 2022).

The Development of Online Self-Disclosure and Self-Concept Clarity

The development of online self-disclosure during adolescence has been examined using a cross-sectional research design (Valkenburg et al., 2011). While this study provided a great deal of valuable information about adolescents' online self-disclosure, it did not reveal the true picture of individual development. Online self-disclosure is culturally specific and the developmental trajectory of Chinese teenagers, who are influenced by the collectivist culture, remains unknown (Rosen et al., 2010). Given the importance of adolescence as a crucial period of development, fostering responsible online self-disclosure to promote overall well-being and prevent addiction to social networking sites is essential (Shabahang et al., 2022).

Regarding the developmental trajectory of self-concept clarity among Chinese adolescents, a study found no significant difference in the level of self-concept clarity among Chinese adolescents aged 11–24 after three surveys per year (Xiang et al., 2023). In addition, one study observed 824 adolescents aged 11–21 in Hong Kong for more than one year, and their self-concept clarity was found to be relatively stable (Wu et al., 2010). Although these studies provide insights into the development of self-concept clarity among Chinese adolescents, the sample age range was very large. Therefore, exploring the development of self-concept clarity among Chinese adolescents in the same grade is necessary.

Furthermore, research has found gender differences in the development trajectories of both online self-disclosure and self-concept clarity (Valkenburg et al., 2011; Xiang et al., 2023). Girls' online self-disclosure during adolescence is higher than that of boys (Valkenburg et al., 2011). Gender differences in online self-disclosure can often be explained by gender role theory. According to Eagly and Karau (2002), gender roles lead to social behaviors of different gender types through social reinforcement of the ideal self and role identification behaviors. In early discussions on gender and disclosure, men were asked to appear strong, objective, hardworking, fulfilled, and not show emotions or feelings (Jourard, 1971). This pressure may limit the breadth and depth of what men can reveal to others about their own inner experiences. However, previous studies have found that, compared to adolescent boys, adolescent girls have a less clear self-concept (Xiang et al., 2023). Based on gender socialization norms, the exploration of a new self can facilitate self-consistency among adolescent boys, as they strive to expand their horizons and embrace risks in pursuit of their objectives. Consequently, there may

be an inherent progression in the development of their self-concept (Elliott, 1988). Conversely, girls exhibit a greater inclination towards interpersonal relationships than boys, and their perceptions of themselves tend to be influenced by others, which can impede the clarity of their self-concept (Joshnloo, 2018).

The Current Study

Although previous studies have demonstrated an interaction between online self-disclosure and self-concept clarity, they have mainly adopted a cross-sectional approach and have not explored the causal relationships between these variables. Therefore, based on self-identity theory and the self-concept fragmentation hypothesis, this study adopted a longitudinal tracking method to conduct four follow-up surveys over 18 months among middle school students and used RI-PLCM to explore the causal relationship between online self-disclosure and self-concept clarity. In addition, the developmental trajectory of Chinese adolescents' online self-disclosure remains unclear, and the existing developmental trajectory of Chinese adolescents' self-concept clarity has the problem of a large sample age span. Therefore, based on the four tracking results, this study used a human-centered method, LGMM analysis, to explore the different development paths of middle school students' online self-disclosure and self-concept clarity. Finally, based on the causal conclusion, multiple logistic regression was used to explore the influence of the predictor variables on the developmental trajectory of the outcome variables. Previous studies have not explored the causal relationship between online self-disclosure and self-concept clarity, nor have they used a human-centered approach to study the developmental characteristics of online self-disclosure and self-concept clarity. Therefore, this study is largely exploratory with some general assumptions. Firstly, it posits an interaction between online self-disclosure and self-concept clarity; however, the influence of self-concept clarity on online self-disclosure surpasses that of online self-disclosure on self-concept clarity due to the greater impact cognition may have on behavior (Hypothesis 1). Secondly, this study hypothesizes that middle school students' online self-disclosure may have two profiles: Group 1 has more online self-disclosure and Group 2 has less (Hypothesis 2). The self-concept clarity of middle school students may also exist in two profiles: Group 1 has a high level of self-concept clarity, and Group 2 has a low level of self-concept clarity (Hypothesis 3). Finally, self-concept clarity significantly affects changes in the developmental trajectory profile of online self-disclosure (Hypothesis 4), while gender significantly affects changes in the developmental trajectory profile of both self-concept clarity and online self-disclosure (Hypothesis 5).

Methods

Participants

Participants were gathered from two middle schools in Huaibei, Anhui, China, using cluster random sampling. Approximately 535 middle school students were enrolled in the study. The sample comprised 304 boys (56.82%) and 231 girls (43.18%). The average age at the first survey was 12.93 ± 0.54 years. This study adopted a longitudinal design and collected data at four time-points over 18 months: T1 (second semester of 7th grade), T2 (first semester of 8th grade), T3 (second semester of 8th grade), and T4 (first semester of 9th grade). During the study period, 9, 81, and 51 students withdrew at T2, T3, and T4, respectively. According to Little's Missing Completely at Random test ($\chi^2_{\text{online self-disclosure}} = 21.21, df = 18, p = 0.27$; $\chi^2_{\text{self-concept clarity}} = 23.78, df = 18, p = 0.16$), the missing data can be considered complete at random.

Prior to data collection, students and their parents provided signed consent to participate. The participants were informed of their freedom to withdraw from the study at any time. Furthermore, participants were assured that their responses would be used solely for research purposes, ensuring the utmost confidentiality of their personal data.

Instruments

Online self-disclosure

The 9-item online self-disclosure scale was used to measure the level of online self-disclosure (Wang et al., 2011). Students stated their viewpoints by checking the number that signaled their tendency to agree with a question described on a 5-point Likert scale (1 = Entirely Incompatible, 3 = Not Sure, 5 = Entirely Compatible). For this sample, two items related to romantic relationships and sex were considered inappropriate for students and therefore deleted from the scale. The final 7-item scale had two dimensions: items 1–4 indicated perceived breadth of online communication and items 5–7 indicated perceived depth of online communication (Wang et al., 2011). The Cronbach's α values at the four time points were: T1, 0.74; T2, 0.78; T3, 0.81; T4, 0.89.

Self-concept clarity

The 12 items of the self-concept clarity scale were used to measure self-concept clarity (Campbell et al., 1996). Students stated their viewpoints by checking the number that signaled their tendency to agree with a question described on a 5-point Likert scale (1 = Entirely Incompatible, 3 = Not Sure, 5 = Entirely Compatible). In this study, the scale had three items with low factor loadings (<0.4), which were

Table 1 Descriptive statistics for online self-disclosure and self-concept clarity for middle school students

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10
1.Gender	0.43	0.50	1									
2.AgeT1	12.93	0.53	−0.06	1								
3.OSDT1	2.95	0.76	0.03	0.02	1							
4. OSDT2	3.09	0.74	0.13**	−0.02	0.42***	1						
5. OSDT3	3.01	0.79	0.13**	−0.02	0.33***	0.52***	1					
6. OSDT4	2.84	0.83	−0.05	−0.06	0.23***	0.31***	0.33***	1				
7.SCCT1	2.71	0.65	−0.15***	−0.03	−0.29***	−0.24***	−0.18***	−0.10*	1			
8. SCCT2	2.77	0.70	−0.23***	−0.02	−0.20***	−0.39***	−0.31***	−0.21***	0.54***	1		
9. SCCT3	2.80	0.67	−0.15**	0.01	−0.18***	−0.28***	−0.35***	−0.18***	0.44***	0.64***	1	
10. SCCT4	3.03	0.73	−0.08	−0.04	−0.10*	−0.11*	−0.17***	−0.52***	0.19***	0.28***	0.32***	1

OSD online self-disclosure, *SCC* self-concept clarity.

“Gender” was a dummy variable, boy = 0, girl = 1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

deleted (Cicero, 2020; Lin et al., 2021). Finally, the 9-item scale’s Cronbach’s α values at the four time-points were: T1, 0.78; T2, 0.85; T3, 0.83; T4, 0.91.

Data Analysis

Data analysis for this study was conducted using SPSS 25.0 and Mplus 8.3. To address the missing values, the full information maximum likelihood procedure was employed (Muthén & Muthén, 2017). Initially, SPSS 25.0 was used to examine common method bias as well as to provide descriptive statistics and correlation analysis for the variables. The study then employed RI-CLPM to examine the causal dynamics between online self-disclosure and self-concept clarity. Subsequently, LGMM was used to delineate the diverse developmental trajectories of online self-disclosure and self-concept clarity among middle school students. To further elucidate the causal mechanisms, binary logistic regression analysis was conducted to assess the impact of antecedent variables on the potential developmental paths of the outcome variables.

Common method bias test

Harman’s one-way test was conducted separately on the four time point datasets to assess the extent to which the four measurements were affected by common method bias. When performing principal component analysis, study found five, four, four, and three eigenvalues greater than 1 for all variables in the four tests, respectively. The findings indicated that the variances explained by the first factor were 21.88%, 28.46%, 26.91%, and 37.78%, respectively, which were all less than the critical criterion of 40%. No significant evidence of common method bias was identified (Podsakoff et al., 2003).

Table 2 Difference comparison of online self-disclosure and self-concept clarity

Instruments	<i>F</i>	Multiple comparisons			
		Comparing objects	Mean difference	SE	<i>p</i>
OSD	8.69***	T1-T2	−0.14	0.05	<0.01
		T1-T3	−0.07	0.05	0.20
		T1-T4	0.11	0.05	<0.05
		T2-T3	0.07	0.05	0.15
		T2-T4	0.24	0.05	<0.001
SCC	20.34***	T3-T4	0.17	0.05	<0.001
		T1-T2	−0.06	0.04	0.15
		T1-T3	−0.09	0.04	<0.05
		T1-T4	−0.32	0.04	<0.001
		T2-T3	−0.03	0.04	0.50
		T2-T4	−0.26	0.04	<0.001
		T3-T4	−0.23	0.04	<0.001

OSD online self-disclosure, *SCC* self-concept clarity

Results

Primary Analysis

Table 1 presents the mean, standard deviation, and correlation coefficient matrix of online self-disclosure and self-concept clarity at the four time points. Notably, a negative correlation was observed between online self-disclosure and self-concept clarity across different test times. Additionally, both variables exhibited moderate stability. Furthermore, significant gender differences existed in online self-disclosure (T2: $t = -3.07, p < 0.01$; T3: $t = -2.71, p < 0.01$) and self-concept clarity (T1: $t = 3.38, p < 0.01$; T3: $t = 5.48, p < 0.001$; T4: $t = 3.19, p < 0.01$). As shown in Table 2, middle school students’ online

self-disclosure initially increased but subsequently decreased from T1 to T4. Conversely, an upward trend was observed for self-concept clarity.

Causal Relationship Between Online Self-Disclosure and Self-Concept Clarity

To gain more insight into the causal relationship between online self-disclosure and self-concept clarity, the RI-CLPM was used to examine the longitudinal relationship between self-concept clarity and online self-disclosure (Lucas, 2023). The conceptual models illustrated in Fig. 1 were constructed to ensure robust estimates. To achieve model parsimony, four variations of the model were tested: Model 1 (unconstrained baseline model), Model 2 (all stability paths fixed as time-invariant), Model 3 (all cross-lagged paths fixed as time-invariant), and Model 4 (both cross-lagged and stability paths fixed as time-invariant). Gender and age at T1 were included

as covariates in the analysis. The results in Table 3 indicate that the most parsimonious model (Model 4) did not significantly worsen model fit compared to the unconstrained model (Model 1). Consequently, study concluded that constraining the cross-lagged and stability paths to be time-invariant was appropriate.

Table 4 presents the RI-CLPM’s cross-lagged and stability path coefficients. At the within-unit level, self-concept clarity at T1 significantly and negatively predicted T2 online self-disclosure ($\beta = -0.11$, $SE = 0.04$, $p < 0.01$), self-concept clarity at T2 negatively predicted T3 online self-disclosure ($\beta = -0.12$, $SE = 0.05$, $p < 0.01$), and self-concept clarity at T3 negatively predicted T4 online self-disclosure ($\beta = -0.09$, $SE = 0.04$, $p < 0.01$). Additionally, at the between-unit level, there was a significant negative correlation between online self-disclosure and self-concept clarity ($r = -0.68$, $p < 0.001$), that is, middle school students with lower self-concept clarity

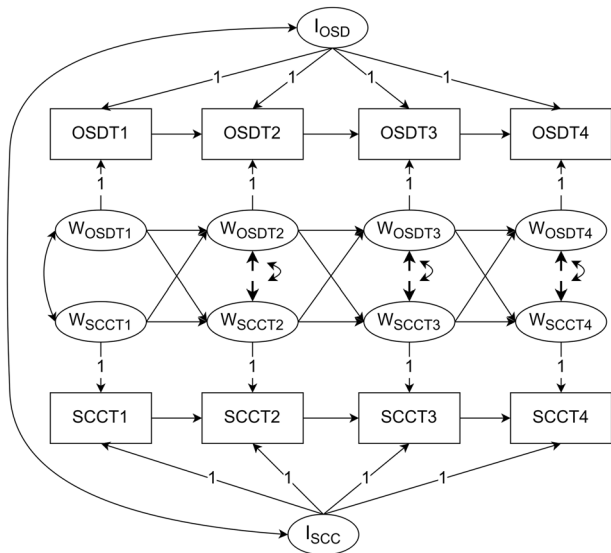


Fig. 1 Random-Intercept Cross-Lagged Panel Analysis for online self-disclosure and self-concept clarity (to make the presentation of the results more concise, paths from control variable are not displayed)

Table 4 Parameter estimation results of random Intercept Cross-Lagged Panel Models

Coefficient of path	Unstandardized		Standardized	
	B	p	β	p
$I_{OSD} \leftrightarrow I_{SCC}$	-0.06	<0.01	-0.68	<0.001
OSDT1 → OSDT2	0.357	<0.001	0.37	<0.001
OSDT2 → OSDT3	0.357	<0.001	0.35	<0.001
OSDT3 → OSDT4	0.357	<0.001	0.31	<0.001
SCCT1 → SCCT2	0.359	<0.001	0.32	<0.001
SCCT2 → SCCT3	0.359	<0.001	0.40	<0.001
SCCT3 → SCCT4	0.359	<0.001	0.27	<0.001
OSDT1 → SCCT2	-0.06	0.066	-0.08	0.07
OSDT2 → SCCT3	-0.06	0.066	-0.08	0.07
OSDT3 → SCCT4	-0.06	0.066	-0.06	0.08
SCCT1 → OSDT2	-0.15	<0.01	-0.11	<0.01
SCCT2 → OSDT3	-0.15	<0.01	-0.12	<0.01
SCCT3 → OSDT4	-0.15	<0.01	-0.09	<0.01

The equivalence restriction in the model is imposed on non-standardized paths, the standardized path coefficients may be unequal

Table 3 Model Fits and Comparisons for random Intercept Cross-Lagged Panel Models

Model	Model fits					Model comparisons				
	χ^2	df	RMSEA	CFI	SRMR	Pairs	$\Delta\chi^2$	Δdf	p	ΔCFI
Model 1	60.07	19	0.07	0.956	0.05					
Model 2	68.90	23	0.06	0.951	0.06	Model 2-Model 1	8.83	4	0.06	0.005
Model 3	60.81	23	0.06	0.959	0.04	Model 3-Model 1	0.74	4	0.88	0.003
Model 4	72.80	27	0.06	0.951	0.05	Model 4-Model 1	12.73	8	0.12	0.005

RMSEA Root Mean Square Error of Approximation, CFI Comparative-of-Fit Index, SRMR Standardized Root Mean Squared Residual

Model 1 = unconstrained baseline model, Model 2 = all stability paths fixed as time-invariant, Model 3 = all cross-lagged paths fixed as time-invariant, Model 4 = both cross-lagged and stability paths fixed as time-invariant

Table 5 The fitting index of linear and non-linear unconditional LGM model

Model	Model fits						Model comparisons				
	χ^2	<i>df</i>	RMSEA	CFI	SRMR	Pairs	$\Delta\chi^2$	Δdf	<i>p</i>	ΔCFI	
OSD	M1	51.38	5	0.13	0.807	0.05					
	M2	1.07	1	0.01	1.000	0.01	M2-M1	50.31	4	<0.001	0.193
SCC	M1	64.51	5	0.15	0.829	0.17					
	M2	5.92	1	0.09	0.986	0.02	M2-M1	58.59	4	<0.001	0.157

RMSEA Root Mean Square Error of Approximation, CFI Comparative-of-Fit Index, SRMR Standardized Root Mean Squared Residual

M1 linear unconditional latent growth model, M2 a nonlinear unconditional latent growth model

tend to have higher online self-disclosure. However, the analysis did not find a significant predictive relationship between online self-disclosure and self-concept clarity at the subsequent stage ($\beta_{T1 \rightarrow T2} = -0.08, SE = 0.04, p = 0.07$; $\beta_{T2 \rightarrow T3} = -0.08, SE = 0.04, p = 0.07$; $\beta_{T3 \rightarrow T4} = -0.06, SE = 0.04, p = 0.08$).

The Developmental Trajectory Profile of Online Self-Disclosure and Self-Concept Clarity and Gender Differences

To examine the changing patterns of middle school students' online self-disclosure and self-concept clarity, study developed linear and nonlinear unconditional LGMs. The linear unconditional model estimated the intercept and slope, where the intercept represents the initial level and all factor loadings were fixed at 1. The slope represents the rate, and factor loadings were set at 0, 1, 2, and 3, based on the survey time. The nonlinear unconditional model incorporates a quadratic term, referred to as the quadratic slope, into the linear conditional model to capture acceleration. Factor loadings were set to 0, 1, 4, and 9, based on the survey time.

Table 5 lists the coefficients and fit indices for the two unconditional models. Evaluation of the fit indices and chi-square difference test revealed that the nonlinear unconditional latent variable growth model provided a better fit to the data than the linear unconditional latent variable growth model, suggesting a curved trend in the development of online self-disclosure and self-concept clarity among middle school students. The nonlinear unconditional latent variable growth model is shown in Fig. 2. The results showed that the intercept variances ($\sigma^2_{\text{online self-disclosure}} = 0.27, p < 0.01$; $\sigma^2_{\text{self-concept clarity}} = 0.23, p < 0.001$) and quadratic slope ($\sigma^2_{\text{online self-disclosure}} = 0.02, p < 0.05$; $\sigma^2_{\text{self-concept clarity}} = 0.02, p < 0.05$) variances were significantly greater than 0, indicating that there were significant individual differences in online self-disclosure and self-concept clarity in middle school, and that there might be different development trajectories in different profiles.

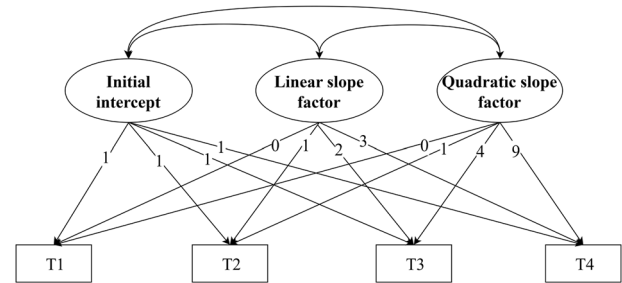


Fig. 2 Nonlinear unconditional LGM of online self-disclosure and self-concept clarity

Utilizing a nonlinear unconditional latent variable growth model, this study delved deeper into the analysis of LGMM for individual differences of online self-disclosure and self-concept clarity. LGMM was employed with 1–5 latent profiles for model fitting analysis. The corresponding fitting indices are listed in Table 6. Table 6 indicates that both online self-disclosure and self-concept clarity exhibit two profiles that fit the data properly with high entropy. The smallest profile in the model accounts for more than 5% of the total sample (Marsh et al., 2009).

The developmental trajectories of the two latent profiles of online self-disclosure among middle school students are illustrated in Fig. 3 and Table 8: Group 1 (C1, $n = 38, 7\%$) exhibits a trajectory characterized by an initial increase followed by a subsequent decline ($B_{\text{intercept}} = 2.76, p < 0.001$; $B_{\text{slope}} = 1.62, p < 0.001$; $B_{\text{quadratic slope}} = -0.67, p < 0.001$), labelled as Rapid change. In contrast, Group 2 (C2, $n = 497, 93\%$) demonstrated a comparatively slower rate of development ($B_{\text{intercept}} = 2.97, p < 0.001$; $B_{\text{slope}} = 0.09, p < 0.05$; $B_{\text{quadratic slope}} = -0.03, p < 0.05$), labelled Slow change. Table 7 presents the average posterior classification accuracy for online self-disclosure.

The developmental trajectories of the two latent profiles of self-concept clarity among middle school students are illustrated in Fig.4 and Table 8: Group 1 (C1, $n = 45, 8\%$) exhibits a trajectory characterized by an initial increase followed by a subsequent decline ($B_{\text{intercept}} = 2.58, p < 0.001$; $B_{\text{slope}} = -0.86, p < 0.001$; $B_{\text{quadratic slope}} = 0.44, p < 0.001$), labelled as Rapid change. However, the level of

Table 6 Fit indices for profiles in online self-disclosure and self-concept clarity

Instruments	Profiles	Loglikelihood	AIC	BIC	aBIC	Entropy	LMR-LRT(<i>p</i>)	BLRT(<i>p</i>)	Classification Proportions
OSD	1	-2155.78	4337.55	4393.22	4351.96				1
	2	-2140.67	4315.34	4388.14	4334.18	0.86	<0.01	<0.001	0.07/0.93
	3	-2136.17	4314.33	4404.26	4337.60	0.79	0.31	0.31	0.08/0.07/0.85
	4	-2132.24	4314.48	4421.53	4342.17	0.85	0.28	0.59	0.89/0.04/0.04/0.03
	5	-2122.41	4302.82	4427.00	4334.95	0.75	0.14	<0.05	0.04/0.04/0.02/0.69/0.21
SCC	1	-1807.35	3640.70	3640.70	3655.11				1
	2	-1798.68	3631.35	3704.15	3650.19	0.80	0.11	<0.05	0.08/0.92
	3	-1783.42	3608.85	3698.77	3632.11	0.85	<0.05	<0.001	0.12/0.03/0.85
	4	-1775.19	3600.38	3707.44	3628.08	0.87	<0.01	<0.05	0.01/0.03/0.13/0.83
	5	-1772.60	3603.20	3727.39	3635.33	0.88	0.14	0.45	0.10/0.01/0.02/0.01/0.86

AIC akaike information criterion, BIC bayesian information criterion, aBIC sample-size adjusted BIC, LMR-LRT lo-mendell-rubin likelihood ratio test, BLRT bootstrapped likelihood ration test, OSD online self-disclosure, SCC self-concept clarity

2-profile model bolded to indicate chosen solution

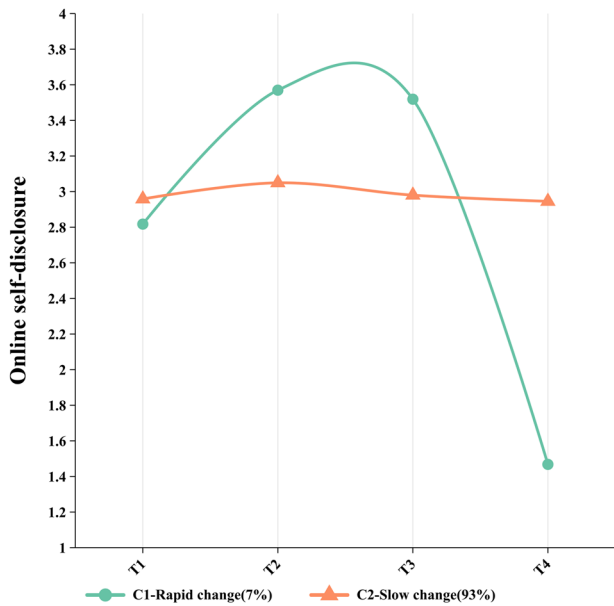


Fig. 3 Development of online self-disclosure in each profile

self-concept clarity in Group 2 (C2, n = 490, 92%) did not change significantly ($B_{intercept} = 2.75, p < 0.001; B_{slope} = 0.05, p = 0.26; B_{quadratic\ slope} = 0.004, p = 0.77$), and was labelled No change. Table 7 presents the average posterior classification accuracy for online self-disclosure.

To further investigate the factors influencing middle school students’ online self-disclosure and self-concept clarity development, this study employed multiple logistic regression analysis to examine the impact of self-concept clarity development category and gender on two potential trajectories of online self-disclosure. The dependent variable was defined as two latent categories representing the change trajectory of online self-disclosure (with C1 “Rapid change” set as the reference). Gender (with female as reference) and

Table 7 Average posterior classification accuracy for online self-disclosure and self-concept clarity

	OSD		SCC	
	C1	C2	C1	C2
C1	0.86	0.14	0.81	0.19
C2	0.03	0.97	0.04	0.96

OSD online self-disclosure, SCC self-concept clarity

C1 profile 1, C2 profile 2

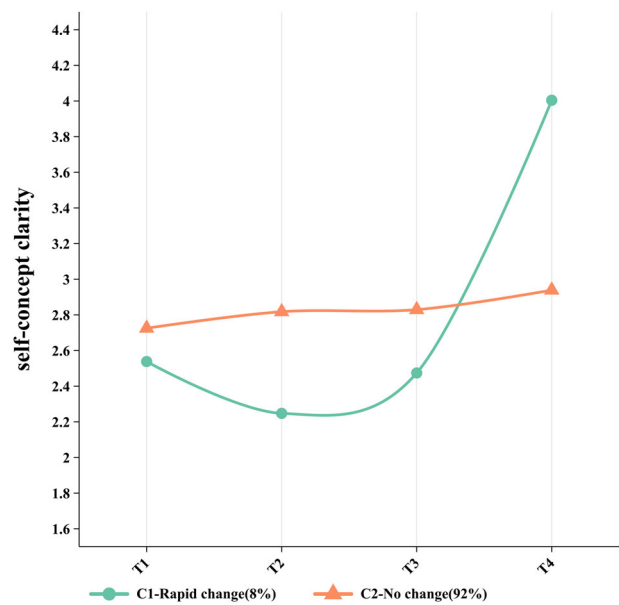


Fig. 4 Development of self-concept clarity in each profile

the latent class of self-concept clarity trajectory (with C1 “Rapid change” set as reference) were used as predictor variables in binary logistic regression analysis. The findings

Table 8 LGGM trend model information

Model			Estimate	SE	t	p
OSD	C1 (7%)	intercept	2.76	0.23	12.16	<0.001
		slope	1.62	0.26	6.28	<0.001
		quadratic slope	-0.67	0.07	-9.29	<0.001
	C2 (93%)	intercept	2.97	0.04	87.07	<0.001
		slope	0.09	0.04	2.10	<0.05
		quadratic slope	-0.03	0.01	-2.46	<0.05
SCC	C1 (8%)	intercept	2.58	0.15	16.99	<0.001
		slope	-0.86	0.19	-4.56	<0.001
		quadratic slope	0.44	0.06	6.82	<0.001
	C2 (92%)	intercept	2.75	0.03	87.18	<0.001
		slope	0.05	0.04	1.13	0.26
		quadratic slope	0.004	0.02	0.29	0.77

OSD online self-disclosure, SCC self-concept clarity

indicate that gender ($p = 0.46$) did not significantly influence the development category of online self-disclosure, whereas the development category of self-concept clarity did exhibit a significant effect ($p < 0.001$, odds ratio = 22.45). Compared with middle school students in C1 of self-concept clarity, those in C2 of self-concept clarity were more inclined to belong to C2 of online self-disclosure, with an odds ratio 22.45 times higher than that of C1 for self-concept clarity. Similarly, the findings indicated that gender ($p = 0.26$) did not significantly influence the development category of self-concept clarity. These findings suggest that alterations in self-concept clarity among middle school students may affect the development of their online self-disclosure.

Discussion

While previous cross-sectional studies have established a correlation between online self-disclosure and self-concept clarity, a significant gap in knowledge exists regarding the causal relationship between these two variables. This study aimed to bridge this gap. Based on the findings of four subsequent surveys, this study provides preliminary evidence supporting the influence of middle school students' self-concept clarity on their online self-disclosure behaviors. Furthermore, LGMM analysis revealed that middle school students can be categorized into two groups in terms of their development of online self-disclosure and self-concept clarity: the majority of students exhibit gradual changes, while a minority undergo rapid transformations. Finally, binary logistic regression was employed to demonstrate the significant impact of changes in middle school students' self-concept clarity on the development and alteration of their online self-disclosure. However, gender did not significantly affect the developmental

trajectory profiles of online self-disclosure or self-concept clarity.

Causal Relationship Between Self-Concept Clarity and Online Self-Disclosure

The RI-CLPM examined the causal relationship between online self-disclosure and self-concept clarity. Furthermore, binary logistic regression was used to verify that the self-concept clarity of middle school students changes quickly, as does the development and change in their online self-disclosure. Per Hypotheses 1 and 4, the results of this study indicate that the lower the self-concept clarity of middle school students, the more their online self-disclosure, which corroborates previous research findings (Fullwood et al., 2016; Strimbu & O'Connell, 2019). Middle school students are at a critical stage of self-concept development. Middle school students with higher self-concept clarity have a clearer understanding of themselves and can better grasp their emotions and needs (Parise et al., 2019). They may have been in the process of regulating their emotions before venting online. In addition, individuals with an unclear self-concept will have difficulty processing self-relevant information and using it to guide their behavior and will be more susceptible to target-irrelevant stimuli that impede self-control (Jiang et al., 2022). Therefore, when confronted with self-related online information, middle school students with low self-concept clarity were induced to engage in more online self-disclosure due to their weak self-control. Furthermore, middle school students with lower self-concept clarity may be more eager to gain recognition and attention from others on social networks (Hsieh et al., 2019). In real life, individuals with low self-concept clarity are less confident in their interpersonal interactions and tend to believe they will be rejected, leading to lower interpersonal adaptability (Tiantian & Hewen, 2022). Owing to the anonymity of social networks, they may tend to fulfill their social needs through online friends, which in turn triggers more online self-disclosure.

The Development of Online Self-Disclosure and Self-Concept Clarity

The findings of this study indicate a gradual change in online self-disclosure among Chinese middle school students, which is consistent with previous research (Valkenburg et al., 2011). Through LGMM analysis, the research finds that the development trajectory of online self-disclosure presents two profiles: the majority (93%) of middle school students exhibited a gradual rate of change, whereas a minority (7%) demonstrated a rapid rate of change, which partially verifies Hypothesis 2. The overall developmental trend indicated an initial increase, followed by a subsequent decrease. However, the developmental trajectory of self-

concept clarity differs from that reported in previous studies. In the majority (92%) of middle school students, self-concept clarity levels remained relatively stable across the four surveys, which is consistent with prior research findings (Wu et al., 2010; Xiang et al., 2023). A small proportion (8%) of middle school students exhibited a pattern characterized by an initial decline followed by subsequent improvement, which constitutes our novel discovery and partially verifies Hypothesis 3. The overall developmental trend is increasing. To a great extent, the development track of middle school students' online self-disclosure and self-concept clarity reflects the characteristics of Chinese middle school students' individual cognition and self-development. Specifically, as students move from 7th to 9th grade, their academic load tends to become heavier; their level of psychological quality deteriorates; and their perception, evaluation, and experience of their own academic status decreases (Cheng et al., 2018). Consequently, a small number of students appear unclear about their self-evaluations and turn to the Internet as an outlet for their academic emotions, leading to an increase in online self-disclosure. Adolescence is a period of expanding social networks and developing social competencies. Middle school students undergo rapid physical and mental changes during this period and tend to have a rich inner world of thoughts and activities, and a strong desire for friendship and understanding from others (Vijayakumar & Pfeifer, 2020). Thus, middle school students naturally seek like-minded friends with whom to express their thoughts. With the widespread use of the Internet, online self-disclosure has become a means for these students to fulfill their social needs and share information regarding their physical and mental development during this crucial stage of adolescence. However, as these students approach 9th grade, they face a looming senior high school entrance examination. Given that only approximately 50% of students are able to advance to high school, both teachers and parents impose restrictions on cell phone usage, including online self-disclosure, further contributing to a decrease in students' online self-disclosure behavior. On the other hand, students' self-concept clarity gradually improves, which may lead to their online self-disclosure behavior becoming more cautious.

In addition, the results of this study showed that girls' levels of online self-disclosure were significantly higher than those of boys at T2 and T3 (eighth grade), which is consistent with the results of previous studies (Valkenburg et al., 2011). Research shows that girls engage in online self-disclosure more frequently than boys during puberty (Valkenburg et al., 2011). However, the findings of this study indicate that no significant gender disparity exists in the change in the developmental trajectory profile of online self-disclosure among male and female students at the middle school level, which does not support Hypothesis 5. In other words, both

male and female students were likely to have two developmental trajectories of online self-disclosure. The study also found that the level of self-concept clarity in boys was significantly higher than in girls, which is consistent with the results of previous studies (Xiang et al., 2023). However, the findings of this study indicate that no significant gender disparity exists in the change in the developmental trajectory profile of self-concept clarity among male and female students at the middle school level, which also does not verify Hypothesis 5. In other words, changes in self-concept clarity were equally likely to occur in boys and girls.

Limitations and Future Research

This study aimed to elucidate the causal dynamics linking online self-disclosure and self-concept clarity among Chinese middle school students. LGMM analysis discerned two distinct developmental trajectories for students in: online self-disclosure and self-concept clarity. However, the interpretation of these findings has certain limitations. First, the scope of the study was limited because of the absence of data from the second semester of the ninth grade, a consequence of school closures precipitated by the pandemic. Future research should encompass the entire academic year to comprehensively chart the developmental arc of online self-disclosure among middle school students. Second, the study's geographical focus on an urban area in central China necessitates caution in generalizing the findings given the pronounced socioeconomic disparities between China's eastern and western regions. The western region's demographic shifts, characterized by an exodus of individuals searching for employment opportunities in the east, has resulted in a higher incidence of left-behind children. Future studies should incorporate nationwide samples to account for these regional differences. Additionally, the reliance on self-reported data from students introduces the potential for social desirability bias, which may skew responses towards socially acceptable norms, thereby affecting the validity of the study. Future research could benefit from employing experimental designs to establish more robust causal links among the variables under investigation. In summary, although this study makes a valuable contribution to the understanding of online self-disclosure among Chinese middle school students, it is imperative to address these limitations and stimulate further research to refine our understanding of this multifaceted phenomenon.

Conclusion

Previous research has established a correlation between the extent of online self-disclosure and clarity of one's self-concept. However, the causal dynamics and developmental progression of this relationship remain underexplored. This

study, utilizing four follow-up surveys and RI-CLPM analysis, revealed a significant influence of middle school students' self-concept clarity on their subsequent level of online self-disclosure. This study also observed a general developmental pattern in which students' online self-disclosure initially increased and then decreased, while their self-concept clarity gradually increased. LGMM analysis further delineated two distinct developmental trajectories for online self-disclosure among middle school students: the majority (93%) experienced a gradual rise, followed by a gradual fall, whereas a minority (7%) exhibited a swift increase, followed by a sharp decline. Similarly, self-concept clarity exhibited two divergent trends: the vast majority (92%) showed little to no change, whereas a small subset (8%) experienced a decline, followed by an ascent. These findings are corroborated by binary logistic regression, which reaffirms the pivotal role of self-concept clarity in shaping the developmental trajectory of online self-disclosure among middle school students. Although there were differences in the levels of online self-disclosure and self-concept clarity between male and female students, there was no significant gender difference in the developmental trajectory profile of online self-disclosure and self-concept clarity. These findings suggest that fluctuations in self-concept clarity can markedly influence the evolution of online self-disclosure.

Data availability

The datasets generated and/or analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

Supplementary information The online version contains supplementary material available at <https://doi.org/10.1007/s10964-024-01964-1>.

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Compliance with Ethical Standards

Conflict of Interest The authors declare no competing interests.

Ethical approval This research complies with APA's ethical standards in treating human samples with the highest ethical standards. The present study was approved by Ethics Committee of Huaibei Normal University.

Informed consent Informed consent was obtained from all participants (adolescents, parents and school principals) included in the study.

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