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EMPIRICAL ARTICLE

CHILD DEVELOPMENT

Trajectories of digital flourishing in adolescence: The predictive roles of developmental changes and digital divide factors

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Abstract

Digital flourishing refers to the positive perceptions of digital communication use in five dimensions: connectedness, positive social comparison, authentic self-presentation, civil participation, and self-control. This three-wave panel study among 1081 Slovenian adolescents (M_{age} = 15.34 years, 53.8% boys, 80.7% ethnic majority) explored the trajectories of their digital flourishing dimensions over 1 year (2021–2022). Latent class growth analysis identified two classes. Adolescents in the first class reported high levels of digital flourishing, which remained stable over time, whereas those in the second class reported low levels of digital flourishing with decreased self-control over time. Autonomy-supportive restrictive, autonomy-supportive active, and controlling active parental mediation styles, together with high parental digital skills, predicted adolescents' belongingness to the (more digitally flourishing) first class.

Digital communication with peers is a prominent part of adolescents' lives (Moreno & Uhls, 2019). Digital communication is "an inclusive umbrella term for multimodal human-to-human social interaction mediated by information and communication technologies" (Meier & Reinecke, 2021, pp. 1183–1184). It contains interpersonal and mass personal "active" communication (e.g., text messaging and posting on social media) and more "passive" social attention (e.g., scrolling on social media) (Meier & Reinecke, 2021). The most preferred forms of digital communication among adolescents are text messaging and social media use (Ehrenreich et al., 2021), which allow adolescents to communicate anywhere and anytime with their peers. These forms of digital communication are frequently used to cope with emotions and seek social support from peers. Social media, in particular, allows adolescents to engage in self-presentation practices and compare themselves with others (Moreno & Uhls, 2019).

Digital communication use has been described to meet the different developmental needs of adolescents (Subrahmanyam & Šmahel, 2011). Adolescence is a developmental period wherein individuals experience significant changes. Owing to the developmental changes, the psychological needs in adolescence differ from those experienced in childhood (Berk, 2014). Some uses of digital communication positively address adolescents' developmental needs (Moreno & Uhls, 2019). These uses are described as digital flourishing (Janicke-Bowles et al., 2023; Rosič et al., 2022) and are the focus of the current research.

Digital flourishing refers to the positive perceptions of an individual's experiences and behaviors in digital communication, which give users a sense of feeling and doing well. The core dimensions measuring how users digitally flourish include connectedness, positive social comparison, authentic self-presentation, civil participation, and self-control (Janicke-Bowles et al., 2023).

Abbreviations: BIC, Bayesian information criterion; BLRT, bootstrap likelihood ratio test; FIML, Full information maximum likelihood; GMM, growth mixture model; LCGA, latent class growth analysis; LMR-LRT, Lo–Mendell–Rubin likelihood ratio test; MCAR, missing completely at random; OSF, Open Science Framework; SES, socioeconomic status.

The current three-wave panel study adopts a developmental perspective. It aims to identify the distinct trajectories of digital flourishing dimensions over 1 year (via latent class growth analysis (LCGA) on a sample of Slovenian adolescents). The study expects to explore the different digital flourishing trajectories for different groups of adolescents, with some trajectories increasing and others remaining stable or even decreasing over time. Next, it explores whether adolescents' developmental changes (i.e., measured based on age) and digital divide determinants (i.e., parental education, ethnicity, parental mediation style, and parental digital skills) predict adolescents' belongingness to different trajectories of digital flourishing. Accordingly, the study contributes to the literature on positive digital communication in adolescents (e.g., Raney et al., 2021). Research has often adopted a harm-focused perspective when studying adolescents' digital communication use; however, adolescents can also be empowered by digital communication (Raney et al., 2021). Understanding how such empowered experiences and behaviors in digital communication (i.e., digital flourishing) may develop differently in adolescents (depending on their developmental status or digital divide background) provides insights into which groups of adolescents' societal actors (e.g., educators, media literacy organizations, and parents) should be targeted when establishing interventions to digitally empower youth.

Digital flourishing in adolescence

Digital flourishing is defined as the positive perceptions of an individual's experiences and behaviors in digital communication (Janicke-Bowles et al., 2023). The concept refers to a perceived mindful approach to digital communication, which enables leveraging digital communication and supports thriving in various life domains while avoiding harm. Digital flourishing is a multidimensional concept and comprises five dimensions: connectedness, positive social comparison, authentic self-presentation, civil participation, and self-control. Connectedness involves the digital communication experiences of connection and belongingness with others online as well as support by one's online community. Positive social comparison occurs when feelings of inspiration, motivation, and overall well-being are triggered after an adaptive social comparison takes place online. Authentic self-presentation relates to experiences in which the user authentically presents themself online. For instance, the user abstains from editing posted content using filters or other editing tools. Civil participation includes a user's perceptions of considerate and reflected digital communication—respectful, open, and polite communication with others when expressing differing viewpoints. Finally, self-control refers to one's perceived ability to control when to start and stop interacting online (for more details, see Janicke-Bowles et al., 2023). Contrary to existing concepts, digital flourishing focuses on the communication level rather than on the time spent with digital media. Thus, digital flourishing is not dependent on a particular device (e.g., smartphones), application (e.g., Instagram), or digital media feature (e.g., private messaging) (Meier & Reinecke, 2021).

The concept of digital flourishing builds on the literature adopting user-centric operationalization, focusing on the users' perceptions of how and why they use digital communication (Meier & Reinecke, 2021). Perceptions about digital communication uses (and thus digital flourishing) are, like other media experiences, socially constructed, and they likely shape how the effects of media use occur (Hansen, 1991). Negative perceptions of digital communication have been associated with negative well-being outcomes (Ernala et al., 2022). Similarly, positive perceptions of digital communication likely impact the actual positive effects in well-being experienced by users (Janicke-Bowles et al., 2023). Note that a user may experience digital flourishing in one dimension while perceiving negative experiences in another. For instance, a user may remain civil in their online debate but simultaneously feel disconnected from their online community because their conversation partners have started ignoring them owing to their considerate answers.

The digital flourishing concept is rooted in the self-determination theory (Deci & Ryan, 2000). This theory postulates that individuals are driven to act to satisfy three basic psychological needs (relatedness, competence, and autonomy), which are essential for hedonic and eudaimonic well-being. Relatedness concerns individuals' need for connection, care toward others, and feeling cared for by others. Competence captures the need to perceive oneself as effective in dealing with one's activities and achieving goals. Autonomy includes the need for control, volition, or freedom when engaging in an activity (Deci & Ryan, 2000). Studies have demonstrated that adolescents communicate online to satisfy their basic psychological needs (Shapka, 2019; Zilka, 2018). For instance, communication with peers through social media offers adolescents a sense of belonging to a group and, therefore, satisfies the need for relatedness. Competence is satisfied in digital communication by learning how to interact with others and learning their responsibilities toward themselves and their online environment. Finally, independent choices in the online activities that adolescents engage in fulfill the need for autonomy (Zilka, 2018). Research that introduced the concept of digital flourishing found that digital connectedness was most highly associated with relatedness need satisfaction, online positive social comparison and civil participation with competence need satisfaction, and online authentic self-presentation and self-control with autonomy need satisfaction among adults (Janicke-Bowles et al., 2023).

So far, knowledge on how digital flourishing occurs among adolescents is lacking. Moreover, whether digital flourishing changes over time in this group of users, who are known for the many changes they encounter at this life stage, is unknown (Eccles et al., 1993). The literature on the basic psychological needs in offline settings and on tangible digital skills can help us understand the potential trajectories of digital flourishing dimensions during adolescence.

Trajectories of basic psychological needs satisfaction and digital skills in adolescence

During adolescence, the needs for autonomy, relatedness, and competence grow. Growing needs can be satisfied via communication in offline and online settings (Shapka, 2019), as both offline communication and digital communication share components and qualities that contribute to the satisfaction of basic needs, such as information disclosure, interactivity, social reward, and social support (Yau & Reich, 2019).

One setting in which offline communication takes place is school. Apart from facilitating communication, schools offer other activities (e.g., attending classes and performing educational tasks), making them an important offline setting where needs can be (dis)satisfied (Eccles et al., 1993; Ratelle & Duchesne, 2014). Prior research has examined the fluctuations in basic psychological need satisfaction in the school setting (Marchand & Skinner, 2007; Ratelle & Duchesne, 2014) and identified different developmental trajectories of how the different needs were satisfied at school. These trajectories showed that adolescents had low-to-high initial levels of relatedness, competence, and autonomy, of which some increased, decreased, or remained stable over time (Ratelle & Duchesne, 2014). Overall, this literature demonstrates that the trajectories of basic need satisfaction likely differ from each other and seem to change over time in adolescence.

Given that the need satisfaction trajectories in schools include offline communication, distinct growth trajectories may also be present in digital flourishing dimensions. The literature on tangible digital skills also hints at the potential presence of digital flourishing trajectories. More precisely, digital flourishing dimensions can be understood as digital skills and the positive outcomes of digital communication activities that satisfy basic needs in an online setting (Janicke-Bowles et al., 2023). Previous research has primarily examined the developmental trajectories of tangible digital skills dimensions (e.g., technical-operational, information-navigation, social-communicative, and content-creation skills) (Machackova et al., 2023). Examples of the digital skills studied include using software, making spreadsheets, and having safe and secure Internet use (Scheerder et al., 2017). Such research has identified that technical-operational skills, programming skills, and digital knowledge increased over time, whereas information-navigation, social-communicative, and content-creation skills increased only slightly or remained stable (Machackova et al., 2023). Nevertheless, the trajectories of digital flourishing dimensions have not yet been investigated.

Given that the concept of digital flourishing is based on the satisfaction of intrinsic needs (Janicke-Bowles et al., 2023) and that longitudinal research has identified changes in adolescents' satisfaction of psychological needs in the school setting and in adolescents' tangible digital skills over time (Machackova et al., 2023; Ratelle & Duchesne, 2014), the current exploratory study aims to explore whether distinct trajectories of digital flourishing dimensions occur among adolescents. Adolescents might experience an increase in, stable, or a decrease in digital flourishing over time. Further knowledge on this can help us understand how digital flourishing evolves in a period in which users typically spend a great deal of time communicating online (Subrahmanyam & Šmahel, 2011). Older adolescents seem to use more social media platforms and be more dependent on them than younger adolescents (Ehrenreich et al., 2021). Given such evolutions, digital flourishing dimensions likely evolve over the course of a year in adolescents. We thus further explore the potential digital flourishing trajectories over a 1-year period based on previous studies, which show fluctuations in digital communication outcomes, such as social media-induced inspiration and envy, over a 1-year period (e.g., Schreurs et al., 2023). Because of the exploratory nature of our study, no hypothesis is formulated regarding the specific number and shape of the trajectories of the digital flourishing dimensions. Therefore, we ask:

RQ1: *Do different growth trajectories of digital flourishing in adolescence exist over the course of a year?*

Considering the heterogeneity in adolescents' digital communication (Valkenburg & Peter, 2013), several factors likely predict why some adolescents belong to increasing, decreasing, or stable trajectories of digital flourishing. Following the prior literature, the membership of one of the distinct trajectories of digital flourishing dimensions likely depends on adolescents' developmental changes (Valkenburg & Peter, 2013) and social context (i.e., factors related to the digital divide) (Scheerder et al., 2017). Therefore, next, we explain how the developmental changes in adolescence and family determinants may relate to the potentially different trajectories of digital flourishing dimensions in adolescence.

Developmental changes in adolescence

During adolescence, major social, emotional, and cognitive developmental changes occur with age (Berk, 2014). Social developmental changes encourage adolescents to become increasingly independent from their parents and turn more frequently to their peers for social

interactions and support. Socialization with peers allows adolescents to increasingly fine-tune their social skills (Subrahmanyam & Šmahel, 2011).

Emotional developmental changes challenge adolescents to define a more organized, complex, and consistent view of their identity and reflect on their values, beliefs, and goals (Berk, 2014; Subrahmanyam & Šmahel, 2011). Whereas children describe themselves via simple personality traits, adolescents combine abstract traits into an organized system and understand that their traits can vary in different situations (Berk, 2014).

Cognitive developmental changes trigger changes in adolescents' intellectual abilities (Steinberg, 2005). With brain maturation, adolescents become more advanced in abstract thinking and hypothetical reasoning (Berk, 2014; Steinberg, 2005). Cognitive changes improve adolescents' skills to regulate emotions, cognitions, and behavior, leading to more mature emotional coping strategies and decision-making (Steinberg, 2005).

Social, emotional, and cognitive development allows adolescents to develop mindful digital communication skills that enable positive outcomes (Ehrenreich et al., 2021). Social development encourages adolescents to extend their offline communication with digital communication (Berk, 2014). Digital communication encourages online self-disclosure and social support, which, in turn, strengthens connectedness with the online community and the quality of offline friendships (Yau & Reich, 2019). Emotional development further allows adolescents to authentically self-present themselves online and to positively compare themselves with others online (Schreurs et al., 2023). Cognitive development enables adolescents to have discussions online in a civil manner (Bowman-Smith et al., 2021). It further contributes to increased self-control over when and how often they engage in digital communication (Shapka, 2019).

Given the differential changes in adolescence (Berk, 2014), the membership of one potential differential trajectory of digital flourishing dimensions might depend on the adolescents' age. Overall, younger adolescents exhibit the highest increase in social, emotional, and cognitive skills (Subrahmanyam & Šmahel, 2011). As such, younger adolescents might likely be members of trajectories with increased digital flourishing compared with older adolescents, whose development is almost complete. Because of the exploratory nature of our study, we ask:

RQ2: *Is the probability of belonging to a trajectory of digital flourishing predicted by adolescents' age?*

Digital divide in adolescence

Adolescents in vulnerable social environments are less likely to benefit from digital communication than adolescents in non-vulnerable environments (George et al., 2020). More precisely, a diminished growth of digital flourishing in adolescence may be attributable to the digital divide. Therefore, the factors that predict the digital divide may also predict the membership of potential digital flourishing trajectories.

Recent digital divide literature has focused on the inequalities in acquired tangible digital skills and the outcomes of digital communication (van Deursen & Helsper, 2015). Regarding digital skills, initial studies were limited to mainly examining technical-operational, information-navigation, social-communicative, and content-creation skills (Scheerder et al., 2017). Social digital skills, such as authentic online self-presentation or civil digital communication, have received little attention in the literature. Regarding digital outcomes, tangible outcomes, such as economic (e.g., finding a job online), social (e.g., expanding the social network), and educational (e.g., formal and informal learning opportunities) outcomes, have been predominantly studied (Scheerder et al., 2017; van Deursen & Helsper, 2015). Nevertheless, how the digital divide manifests itself in subjective positive outcomes (e.g., perceived feelings of connectedness to the digital society) is still poorly understood (Büchi et al., 2018). This research gap is problematic, as vulnerable adolescents can gain the most from digital flourishing. However, they appear to be the least supported in establishing empowered uses of digital communication (George et al., 2020).

Some of the most significant determinants of the digital divide among adolescents in the literature are family socioeconomic background (socioeconomic status [SES]), family ethnic background, parental mediation, and parents' digital skills (Scheerder et al., 2017).

Regarding family SES (i.e., parental education, income, and occupation) (Ren et al., 2022), a rich body of literature has demonstrated that adolescents with a low SES exhibited significantly lower levels of digital skills, such as information-navigation skills, than those with a high SES (Helsper, 2020; Zilka, 2018). In general, adolescents with a low SES have also reported more negative and fewer positive outcomes of digital communication than adolescents with a high SES. Such differences have been found for social (e.g., less frequent social interactions with their social network and more peer relationship difficulties), educational (e.g., lower academic performance), and personal and emotional (e.g., less increased happiness through online entertainment, more emotional difficulties, hyperactivity, and psychological distress) outcomes (Bohnert & Gracia, 2022; George et al., 2020; Helsper, 2020).

The first study on digital flourishing in adults aligns with these results and reports that higher income and education were positively related to higher digital flourishing (Janicke-Bowles, 2023). Prior research suggests that adolescents with low-educated parents have a lower probability of belonging to trajectories with increased digital flourishing and a higher probability of belonging

to trajectories with decreased digital flourishing. Given that the different digital flourishing trajectories are yet to be explored, we refrain from formulating a hypothesis and instead ask:

RQ3: *Is the probability of belonging to a trajectory of digital flourishing predicted by adolescents' parental education?*

Regarding ethnic background, youth with an ethnic minority background (e.g., Black and Hispanic youth in the United States or the Turkish minority children in five European countries including Austria, Bulgaria, Denmark, Germany, and the Netherlands) have been shown to exhibit lower levels of technical-operational digital skills compared with their peers with an ethnic majority background (e.g., White youth) (D'Haenens & Ogan, 2013; Hecker & Briggs, 2021). Ethnic minority adolescents (i.e., Turkish minority) also experienced more online risks than ethnic majority adolescents (i.e., European majority), such as cyberbullying (D'Haenens & Ogan, 2013). Adolescents belonging to ethnic minorities were also less likely to be helped or guided by their parents with their digital communication uses, as these parents lacked digital skills or were not fluent native speakers (D'Haenens & Ogan, 2013).

This imbalance, however, was not found in the one study examining digital flourishing among adults (Janicke-Bowles, 2023). In this study, digital flourishing, in general, did not differ across ethnic groups. Interestingly, one difference emerged for the digital flourishing dimension of positive social comparison: This dimension was significantly higher among Blacks and Hispanics than among Whites (Janicke-Bowles, 2023). Given that this was the first study to report such a difference, speculating on why the difference occurred is difficult. Moreover, it appears more likely that digital flourishing in ethnically diverse adolescents would evolve in a manner consistent with how other digital divide literature has reported differences in their digital skills and outcomes (D'Haenens & Ogan, 2013). Thus, we question:

RQ4: *Is the probability of belonging to a trajectory of digital flourishing predicted by adolescents' ethnic background?*

Regarding parental mediation, parents not only shape the home media ecology by purchasing digital media but also co-use digital communication with their children and guide their digital communication (Kliewer et al., 2006). Research has documented that parental mediation (i.e., parental practices of managing and regulating children's digital communication experiences) is related to adolescents' digital communication skills and outcomes. The first conceptualization of parental mediation distinguished between a restrictive mediation strategy (i.e., setting rules and managing children's access to or time spent on digital communication) and an active mediation strategy (i.e., discussions with children about online content) (Livingstone et al., 2015). Another study refined the concept of parental mediation and underlined the importance of a particular style in which either an active or a restrictive mediation strategy was implemented. The autonomy-supportive restrictive and autonomy-supportive active parenting styles are applied when parent–child discussions about digital communication explain digital measures and consider the child's opinion. These styles are associated with advanced digital skills and positive outcomes (Valkenburg et al., 2013). In contrast, the styles encouraging lower support of autonomy, such as the controlling active or controlling restrictive style (i.e., obedience-oriented and using punishments or other types of pressure) and an inconsistent restrictive style (i.e., unpredictable use of parental mediation to avoid short-term conflict), were related to decreased digital skills and negative outcomes (e.g., problematic smartphone use) (Meeus et al., 2019; Valkenburg et al., 2013). Based on this literature, we may reason that autonomy-supportive active and autonomy-supportive restrictive mediation styles increase adolescents' probability of belonging to trajectories with increased digital flourishing, whereas the reverse is true for adolescents who experience controlling restrictive, controlling active, and inconsistent restrictive mediation styles. Therefore, we ask:

RQ5: *Is the probability of belonging to a trajectory of digital flourishing predicted by adolescents' parental mediation style?*

Parental digital skills may play an important role in the level and growth of digital flourishing, as parents co-use digital communication with their children and adolescents learn by observing parental behavior and modeled skills (Kliewer et al., 2006). Some research signaled that adolescents with less digitally skilled parents were likely to have lower levels of digital skills and experience fewer positive outcomes of digital communication than adolescents with more digitally skilled parents. Digitally skilled parents were also more likely to guide their children's digital communication and help them with online troubles (D'Haenens & Ogan, 2013). Moreover, parents with higher digital skills tended to engage in diverse digital activities (e.g., applying for jobs, online banking, reading the news, and connecting with family and friends). Therefore, they were more likely to signal digital opportunities for their children (e.g., opportunities for learning new information and skills and new ways of self-expression). This signaling of digital learning opportunities was, in turn, shown to predict broader online uses among their children (e.g., informing themselves and engaging in artistic uses) (Katz et al., 2019). Thus, we propose that higher parental digital skills amplify adolescents' probability of belonging to trajectories with increased digital flourishing and question:

RQ6: *Is the probability of belonging to a trajectory of digital flourishing predicted by adolescents' parental digital skills?*

METHOD

Procedure and sample

This preregistered study was part of a larger three-wave panel survey of the "MIMIc Project" focusing on media and adolescents' well-being. More information about the project is available at https://www.projectmimic.eu/ and in Rosič et al. (2022). The study was approved by the ethical commissions of the KU Leuven and the University of Ljubljana. The participant sample was stratified based on the adolescents' grade, gender, and educational track. Schools were selected from different Slovenian regions using a government-provided list to reach 1500 adolescents. However, to achieve the expected sample size, additional schools were randomly included. This decision increased the number of participants but led to a trade-off with the sample's representativeness. Appendix A in Open Science Framework (OSF) (https://osf.io/9n3zg) presents comparisons of the sample with the general population. A quota sample of 1251 adolescents aged 11–21 was recruited from 27 primary and secondary schools in Slovenia. Participating schools presented the study's aims to the participants, provided parental consent forms to them, and helped disseminate the online survey link and active consent sheets. Active (<16 years) or passive informed parental consent (≥16 years) and informed consent from the participants were obtained. Participants completed an online survey at three time points over 4-month intervals in September–November 2021 (T1), February–April 2022 (T2), and July–September 2022 (T3). Due to the coronavirus disease 2019 pandemic, surveys were mostly administered at home, except for eight schools, where they were administered during school hours. Participants were rewarded with a €10 voucher at T1, a €12 voucher at T2, and a €15 voucher at T3.

Out of the 1251 participants, those with missing data on all items of the digital flourishing scale for adolescents ($n=46$) were excluded. Participants who failed or had missing data on the attention check in at least one of the three surveys were also excluded from the analyses ($n=124$). The final analytical sample included 1081 participants (53.8% boys, $M_{age}=15.34$ years, $SD_{age}=1.76$). On average, participants' mothers had a higher level of education than their fathers, and 80.7% of the participants had an ethnic majority background (Table 1). From these 1081 participants, we matched 407 cases across the three surveys and 306 cases across two of the three surveys; 368 cases included those who only participated in one of the three surveys.

Little's missing completely at random (MCAR) test showed that the data were not completely missing at random ($\chi^2(4365)=4731.249, p<.001$). Logistic regression analyses (Table S1) showed that missing cases relate to known characteristics such as gender and can thus be considered missing at random (Gelman & Hill, 2007). Boys were less likely than girls to complete all items, except connectedness and civil participation at T3. They might have found some digital flourishing items less applicable to them or were less likely to know their parental digital skills, education, or ethnicity (the category "Not applicable to me/I don't know" was coded as a missing value).

In addition, chi-square tests and independent *t*-tests (Supporting Information S2) showed that adolescents who completed only one of the three surveys were those with minority background, boys, and older adolescents. Similar to other longitudinal research among adolescents (Erreygers et al., 2018), we retained all participants in the analytical sample to ensure as high representativeness of the Slovenian population of adolescents as possible. Full information maximum likelihood (FIML) in Mplus was used to handle missing data patterns, as the listwise deletion of cases with missing values may bias the results (Enders, 2001).

Measures

The measures were translated from English to Slovenian following a forward- and back-translation procedure. Appendix B in OSF displays all items of the used scales (https://osf.io/dyv9g). The category "I can't respond" or "I don't know" was coded as a missing value. The reliability of the scales was interpreted as acceptable if McDonald's omega (ω) ≥ .7 and as good if $\omega \geq .8$ (McNeish, 2018).

Adolescents' age (2021–birth year) and *gender* were asked at all three time points (1 = boy, 2 = girl, 3 = other, and 4 = prefer not to say; the answers 3 and 4 were coded as missing values for the gender variable owing to the low number of participants ($n_3=18$, $n_4=9$)).

Parental education was measured at T1 separately for the mother or female guardian and the father or male guardian with five categories ranging from "Unfinished primary education" to "Professional higher education and university" with an option "I can't respond." The answers to "I don't know, but my dad/mum works as a:" were recoded into relevant education categories: 1 = completed secondary education or less (low education) and 2 = completed tertiary education (high education).

Ethnic background was assessed at T1 with 13 categories allowing multiple responses (e.g., Central European and West European) and recoded as 1 = only Central European (Slovenian) (ethnic majority background) and 2 = Central European (Slovenian) and/or background other than Central European (Slovenian) (ethnic minority background). The answers to "Other, specify:" were recoded into the existing categories.

The frequency of digital communication was assessed for descriptive purposes at all three time points by asking how much time on average per day have the participants spent communicating online in the past 4 months (Janicke-Bowles et al., 2023). The meaning of online communication was explained in the survey (see appendix B in OSF). Answer options ranged from 0 to 24 h with a 30-min increase (e.g., 0 h, 30 min, and 1 h) and were recoded to the number of minutes. Results were reported in a conventional time format.

Digital flourishing in adolescence was measured at all three time points using the 21-item digital flourishing scale for adolescents (Rosič et al., 2022) ranging from 1 (*not at all true of me*) to 5 (*very true of me*) with an option "I don't know/Not applicable to me" (e.g., "I show my true self online."). This scale's factor structure was established in previous research based on the pilot data and T1 data described therein (Rosič et al., 2022). Mean scores for each subscale were computed at each time point. The subscales yielded good or acceptable reliability at all time points; however, the reliability of connectedness was only moderately acceptable at T3 (authentic self-presentation (ω_{T1} = .872, ω_{T2} = .899, ω_{T3} = .878), positive social comparison (ω_{T1} = .814; ω_{T2} = .845, ω_{T3} = .828), self-control (ω_{T1} = .809, ω_{T2} = .821, ω_{T3} = .822), civil participation (ω_{T1} = .760, ω_{T2} = .819, ω_{T3} = .848), and connectedness (ω_{T1} = .760, ω_{T2} = .754, ω_{T3} = .666)).

Parental mediation was measured at T2 with a modified version of the perceived parental media mediation scale (Valkenburg et al., 2013) adapted by Meeus et al. (2019). Two altered items measured restrictive and active parental mediation strategies regarding digital communication on a five-point Likert scale ranging from 1 (*never*) to 5 (*very often*) (Restrictive mediation: "How often do your parents tell you that you can't communicate online for too long or after a certain time? That you can't use a phone at the table, for example, or you can't use a tablet too often." Active mediation: "How often do your parents talk to you about online communication? They talk to you, for instance, about how people can be very different on their social media profile than in real life, that you have to be careful about sharing information about yourself, or about what kind of apps you use on a phone."). Next, the parental mediation style (e.g., autonomy-supportive active mediation: "My parent would encourage me to voice my own opinion.") was measured with items on a scale ranging from 1 (*not at all true*) to 5 (*very true*). Each item reflected a separate mediation style: autonomy-supportive restriction, controlling restriction, inconsistent restriction, autonomy-supportive active mediation, and controlling active mediation. In line with Meeus et al. (2019), we focused on parental mediation styles instead of the frequency of implementing the mediation strategy. Therefore, only the follow-up items were used for analysis. The scale by Meeus et al. (2019) was chosen because it demonstrated good psychometric properties in their study and offers a short measure, which is highly recommended in longitudinal research to ensure minimal burden on respondents (Robins et al., 2001).

Parental digital skills were captured at T2 using two altered items from the mobile skills subscale of the digital skills scale for school children (Li & Hu, 2020) (e.g., "My parents know how to take photos on a mobile device.") and three altered items of the social skills subscale from the digital skills scale (Ren et al., 2022) (e.g., "My parents know which information they should and shouldn't share online.") (The word "I" was replaced with "my parents."). A scale ranging from 1 (*not at all true*) to 5 (*very true*) with the option "I don't know" was used. The average mean score of the subscales was computed. Correlation analysis between the two items measuring mobile skills was conducted (r = .496, p < .01). Principal component analysis with oblimin rotation of the three items measuring social skills. The Kaiser–Meyer–Olkin test (KMO = .692, $\chi^2(3) = 496.930$, p < .001) accounted for 67.7% of the variance (all item loadings >.804). The scale displayed good reliability (ω = .762).

Data analysis

The hypotheses and analytical strategy were preregistered after data collection but before data analysis. The dataset and analyses can be found in OSF (https://osf.io/h3z6d/). The three-step approach explored the associations between a latent class variable and predictor variables (Asparouhov & Muthén, 2014). In the first step, the latent class model was estimated using only the latent class indicator variables (i.e., identification of the trajectories; Asparouhov & Muthén, 2014). This answered RQ1. In the second step, a nominal class variable was created that indicates the most likely class membership for each adolescent using the latent class posterior distribution obtained from the final class model in the first step (Asparouhov & Muthén, 2014). Finally, in the third step, regression models were estimated using predictor variables and the most likely class membership variable as the outcome variable while considering the misclassification in the second step (i.e., predictors of trajectories; Asparouhov & Muthén, 2014). This answered RQ2–RQ5.

Identifying trajectories

For the first step of the three-step approach, in which the latent class model is estimated and the trajectories of digital flourishing dimensions are identified (RQ1), we conducted LCGA (Jung & Wickrama, 2008) using Mplus 8.9 (Muthén & Muthén, 2017). LCGA investigates different growth trajectories within a population by categorizing

individuals into subclasses based on how they respond (Jung & Wickrama, 2008). We tested several class solutions, whereby each class represents a growth trajectory indicated by an intercept (i.e., the average level of the digital flourishing dimensions measured at T2) and slope (i.e., the average change in digital flourishing dimensions across the three time points). Note that we centered the variables at T2, as this was when the parenting variables were measured.

In LCGA models, the (co-)variances of the growth parameters are constrained to zero, which imposes that individuals within a class have similar growth trajectories. Growth mixture models (GMMs) that do not constrain these variances frequently have estimation difficulties (e.g., Wardenaar, 2020), which was also the case for these data. Thus, we modeled LCGA. The trajectories of each subscale of digital flourishing (i.e., connectedness, civil participation, positive social comparison, authentic self-presentation, and self-control) were estimated in parallel.

The number of class solutions depended on whether adding classes improved model fit, classification accuracy, and/or interpretation of the classes. Model fit assessment was based on the Bayesian information criterion (BIC). Lower BIC indicates a better fit. We also used the Lo–Mendell–Rubin likelihood ratio test (LMR-LRT) and the bootstrap likelihood ratio test (BLRT). These statistics provide a p-value indicating whether a class solution is statistically better than a class solution with one class less ($p < .050$). Classification accuracy was evaluated based on the average class membership probability. Values close to 1 indicated good classification. Probabilities between .80 and .90 were acceptable. Entropy with values above .6 was considered adequate (Weller et al., 2020). A class was also considered appropriate if it had a minimum size of 5% of the total sample or 50 participants (Weller et al., 2020). As proposed in the guidelines for latent class analysis, we selected the model by considering a compromise between all the mentioned criteria (Jung & Wickrama, 2008).

Predictors of trajectories

We further predicted class membership. First, we created a nominal class variable that indicates the most likely class membership for each adolescent based on the final class solution of the LCGA (i.e., the second step of the three-step approach; Asparouhov & Muthén, 2014). For this variable, we considered the uncertainty associated with assigning participants to classes. In particular, the logits for the classification probabilities for the most likely class membership were used to specify the measurement error. These logits were obtained in the final LCGA solution (Asparouhov & Muthén, 2014).

Then, predictor variables were regressed on the most likely class membership variable (i.e., the third step of the three-step approach; Asparouhov & Muthén, 2014). As the final solution indicated two distinguishable trajectories, we used logistic regressions in Mplus 8.9 to predict the probability of belonging to the identified trajectories of digital flourishing dimensions considering developmental changes (i.e., age) and digital divide determinants (i.e., parental education, ethnicity, parental mediation style, and parental digital skills) (RQ2–RQ5). Estimates from this analysis indicate the extent to which, for example, higher levels of parental mobile digital skills increase the probability of belonging to the trajectory of Class 1 relative to Class 2.

Finally, we examined the observed means and proportions of the predictive variables by class using SPSS.

RESULTS

Descriptive statistics

Table 1 shows the descriptive statistics for all study variables. On average, adolescents reported that they spend around 2 h a day communicating online. The observed average levels of digital flourishing dimensions were slightly above the midpoint of their scale. The levels of parental controlling and inconsistent restriction were low, whereas the levels of autonomy-supportive restriction, controlling active mediation, and autonomy-supportive active mediation were around the midpoint of their scale. Observed averages in parental digital skills were relatively high.

Identifying trajectories

Average trajectory

Figure 1 shows the estimated average trajectory of connectedness, civil participation, positive social comparison, authentic self-presentation, and self-control in parallel over time. The average reported level of positive social comparison at T2 was 3.322. Its trajectory was linear, whereby adolescents' level of positive social comparison increased ($B = .059$, $p = .003$). The average reported level of authentic self-presentation at T2 was 3.439. Authentic self-presentation also demonstrated an increasingly linear trajectory ($B = .069$, $p < .001$). The average reported level of connectedness at T2 was 3.262. The trajectory of connectedness remained stable ($B = .038$, $p = .051$). Self-control had an average reported level of 3.618 at T2 and a stable trajectory ($B = -.009$, $p = .630$). The average reported level of civil participation at T2 was 3.729, and its trajectory remained stable ($B = -.022$, $p = .222$).

TABLE 1 Descriptive statistics and zero-order correlations of study variables ($n = 1081$).

				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	T	*M*/%/h	SD	*r*																													
1. Connectedness	1	3.22	0.84	1	.44**	.43**	.07*	.05	.01	.30**	.09*	.16**	.22**	.11**	.09	−.01	−.02	−.04	.12**	−.08*	.04	.13**	−.02	.03	.06	.01	−.03	−.04	−.05	.01	.08	.02	.08
2.	2	3.28	0.81		1	.42**	.05	.18**	.01	.12**	.18**	.20**	.05	.14**	.02	−.08*	−.01	−.10	.14**	.00	.08*	.14**	.09*	.09*	.11**	−.08*	−.01	−.01	−.05	−.01	.08	.08	−.04
3.	3	3.29	0.79			1	.07	.08	.15**	.22**	.10	.21**	.02	.09	.20**	−.11*	−.03	.05	.22**	.08	.10	.17**	−.00	.04	.08	.01	−.09	−.10	−.07	.03	.07	.08	.07
4. Civil participation	1	3.74	0.71				1	.49**	.47**	.22**	.18**	.09	.28**	.23**	.15**	.32**	.23**	.20**	−.04	.09*	−.07	−.03	.15**	.18**	.19**	−.01	.155**	−.01	−.05	−.04	−.14**	−.06	−.20**
5.	2	3.75	0.70					1	.56**	.13**	.34**	.19**	.25**	.37**	.16**	.18**	.37**	.29**	−.08*	.15**	−.11**	.05	.23**	.25**	.26**	.01	.187**	−.06	−.05	−.11**	−.07	−.05	−.08
6.	3	3.69	0.77						1	.06	.17**	.26**	.25**	.20**	.29**	.24**	.19**	.39**	−.16**	.18**	−.03	−.00	.24**	.27**	.25**	.09	.16**	−.11*	−.14**	−.05	−.22**	−.08	−.08
7. Positive social comparison	1	3.27	0.83							1	.49**	.46**	.22**	.11**	.16**	.10**	.08	.03	.05	.06	.04	.06	.08*	.05	.04	−.05	.04	−.01	−.03	−.03	−.03	.01	−.01
8.	2	3.31	0.83								1	.50**	.14**	.21**	.18**	.13**	.19**	.15**	.04	.14**	.05	.05	.18**	.05	.04	.01	.01	−.04	.00	−.07	.02	−.01	.04
9.	3	3.39	0.81									1	.18**	.13*	.26**	.06	.12*	.21**	.04	.14**	.09	.06	.20**	.10	.07	.01	−.06	−.03	−.06	−.05	.04	−.06	−.13*
10. Authentic self-presentation	1	3.36	0.84										1	.57**	.50**	.20**	.19**	.14**	.01	.06	−.01	.06	.14**	.14**	.10*	.00	.09**	−.09**	−.06	.01	−.07	−.11*	−.15*
11.	2	3.46	0.84											1	.58**	.16**	.27**	.19**	−.07	.14**	−.06	.05	.19**	.19**	.16**	−.03	.13**	−.10**	−.03	−.01	−.03	−.04	−.06
12.	3	3.49	0.78												1	.14**	.17**	.39**	−.09	.10	−.05	−.01	.18**	.08	.10	.04	−.00	−.12*	−.13**	.02	−.09	.06	−.14*
13. Self-control	1	3.63	0.73													1	.46**	.44**	−.17**	.12**	−.14**	−.06	.08*	.09*	.04	−.03	−.04	−.06	−.06	−.04	−.16**	−.03	−.08
14.	2	3.60	0.74														1	.42**	−.06	.19**	−.20**	.03	.14**	.18**	.18**	−.12**	−.03	−.06	−.02	−.06	−.09	.04	−.04
15.	3	3.62	0.78															1	−.23**	.20**	−.18**	−.12*	.16**	.12*	.11*	.00	−.15**	−.07	−.09	−.03	−.05	−.00	−.03
16. CR	2	2.33	1.13																1	−.19**	.16**	.25**	−.16**	−.05	−.06	−.11**	−.00	.05	.06	−.02	.02	−.05	−.01
17. ASR	2	3.34	1.05																	1	.01	−.07	.29**	.15**	.17**	−.05	.08	−.04	−.02	−.02	−.03	−.09	.08
18. IR	2	2.60	0.98																		1	.09*	−.02	−.12**	−.09*	.05	.04	.06	−.01	.07	.10	.02	.10
19. CAM	2	3.23	0.93																			1	−.23**	.10*	.02	−.01	.04	.01	.04	−.06	−.03	−.04	−.02
20. ASAM	2	3.22	0.91																				1	.15**	.16**	−.07	.00	−.06	−.05	−0.01	−.00	−.08	−.12
21. Parental mobile digital skills	2	4.08	0.80																					1	.71**	−.28**	.08*	−.07	−.05	−.05	−.04	−.09	−.00
22. Parental social digital skills	2	4.17	0.74																						1	−.23**	.13**	−.07	−.06	−.06	−.03	−.05	.04
23. Age	1	15.34	1.76																							1	−.09**	−.02	−.06	.15**	.04	.09	.00
24. Gender (boy)	1–3	53.8	0.50																								1	.02	.01	−.03	.04	−02	.10
25. Education father (low)	1	51.4	26.25																									1	.65**	.05	.05	.05	−.00
26. Education mother (low)	1	35.0	20.98																										1	.04	.04	−.04	−.03
27. Ethnicity (majority)	1	80.7	0.40																											1	−.03	.08	.08
28. Time	1	2:05	2:31																												1	.09**	.16*
29. Time	2	1:51	2:20																													1	.19*
30. Time	3	1:29	1:50																														1

Note: The variable gender was coded as 1 = boy and 2 = girl; parental education was coded as 1 = low education and 2 = high education; and ethnicity was coded as 1 = ethnic majority background and 2 = ethnic minority background.

Abbreviations: ASAM, autonomy-supportive active mediation; ASR, autonomy-supportive restriction; CAM, controlling active mediation; CR, controlling restriction; IR, inconsistent restriction; *M*, mean; *r*, pairwise correlation; SD, standard deviation; *T*, time point; Time, time spent communicating online.

*$p < .05$; **$p < .01$.

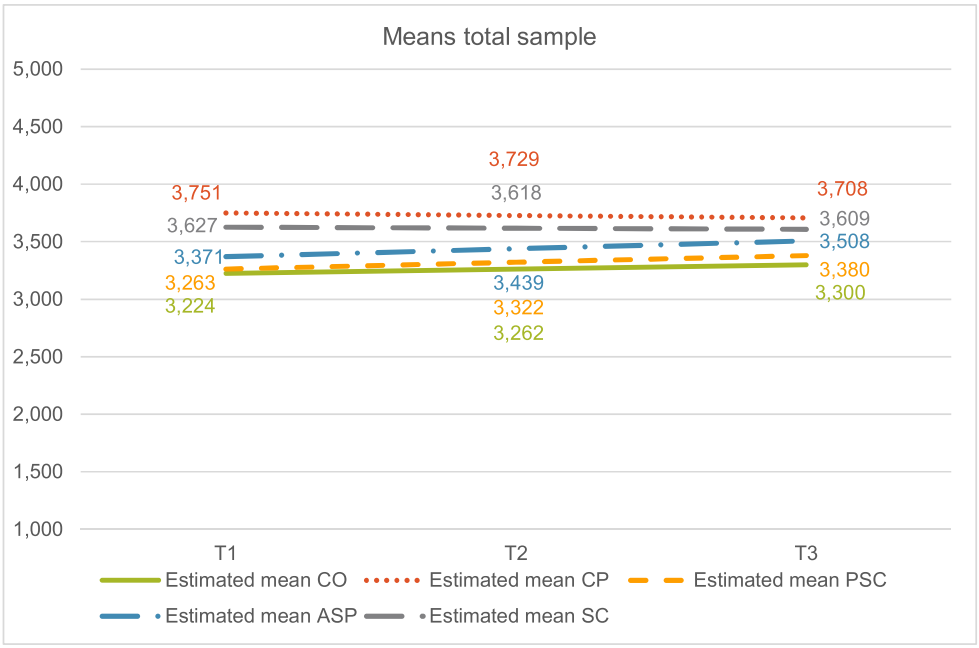

FIGURE 1 Average co-trajectory of digital flourishing dimensions (n = 1039). Data labels show the model's estimated means based on the one-class solution. ASP, authentic self-presentation; CO, connectedness; CP, civil participation; PSC, positive social comparison; SC, self-control.

TABLE 2 Model fit indices and classification accuracy of latent class growth analysis models (n = 1039).

Par.	Class	BIC	Entropy	LMR-LRT value	LMR-LRT p-value	BLRT p-value	Min class size	Max class size	Min probability	Max probability
25	1	24,237.942					1039	1039	1	1
36	2	23,418.062	.633	884.707	<.001	<.001	513	526	.894	.884
47	3	23,238.252	.757	252.906	.2216	<.001	22	570	.861	.900
58	4	23,045.745	.755	265.439	.0181	<.001	22	464	.710	.890
69	5	22,969.932	.754	150.253	.2356	<.001	21	496	.808	.925
80	6	22,907.619	.736	136.927	.2052	<.001	10	480	.774	.972

Abbreviations: BIC, Bayesian information criterion; BLRT, bootstrap likelihood ratio test; LMR-LRT, Lo–Mendell–Rubin likelihood ratio test; Max., maximum; Min., minimum; Par., number of free parameters.

Model selection

Table 2 shows the fit indices and classification accuracy of six LCGA models. The BIC decreased until the final model, and the BLRT p-value indicated that adding classes improved model fit compared with a model with one class less (p < .001). However, for model 3, the decrease in the BIC was relatively small, and the LMR-LRT p-value was non-significant (p = .2216), suggesting that the model is not statistically better than model 2. Moreover, the class size of the third class was smaller than 5% or less than 50 participants. The LMR-LRT p-value for model 4 was significant, but its class size was also smaller than 5% or less than 50 participants. We selected and further interpreted the two-class solution from these models because this model showed the best model fit according to all fit indices. Furthermore, class membership probability and entropy were appropriate.

Interpretation of trajectories

Table 3 presents the model estimates and group sizes of the classes from the two-class solution. Figure 2 shows the estimated means of the five digital flourishing dimensions. Class 1 comprised 50.6% of the participants, who reported relatively high initial levels of digital flourishing dimensions. Positive social comparison (M_{T2} = 3.618) followed a linear trend and increased over time. However, the members' relatively high levels of civil participation (M_{T2} = 4.073), self-control (M_{T2} = 3.904), authentic self-presentation (M_{T2} = 3.837), and connectedness (M_{T2} = 3.434) remained stable over time.

Class 2 comprised 49.4% of the participants, who reported lower initial levels of digital flourishing than those in Class 1. Self-control (M_{T2} = 3.318) followed a linear trend and decreased over time. Authentic self-presentation (M_{T2} = 3.029) also followed a linear trend

but increased over time. Meanwhile, civil participation (M_{T2}=3.376), connectedness (M_{T2}=3.085), and positive social comparison (M_{T2}=3.013) remained stable over time.

TABLE 3 Model estimates for a 2-class solution.

	Class 1: *n* = 526 (50.6%)			Class 2: *n* = 513 (49.4%)		
	High and stable digital flourishing			Low digital flourishing and decreasing self-control		
	B	SE	*D*	*B*	SE	*D*
Connectedness						
Intercept	3.434***	.047	a	3.085***	.043	b
Slope	−0.013	.029	a	0.054	.029	a
Civil participation						
Intercept	4.073***	.039	a	3.376***	.049	b
Slope	−0.011	.023	a	−0.052	.028	a
Positive social comparison						
Intercept	3.618***	.056	a	3.013***	.046	b
Slope	0.059*	.028	a	0.041	.030	a
Authentic self-presentation						
Intercept	3.837***	.044	a	3.029***	.060	b
Slope	0.043	.024	a	0.071**	.029	a
Self-control						
Intercept	3.904***	.047	a	3.318***	.043	b
Slope	0.025	.025	a	−0.060*	.029	b

Note: Columns with different letters denote estimates that significantly differed across the classes.

Abbreviations: *B*, unstandardized coefficient; *D*, difference; SE, standard error.

*p<.05; **p<.01; ***p<.001.

To better understand the differences between the two classes, we compared the parameter estimates by calculating the difference parameters (Boer et al., 2022). The intercepts of all digital flourishing dimensions appeared to significantly differ from each other (Table 3). In Class 1, the mean intercepts of each dimension were significantly higher than those in Class 2. Moreover, the mean slope of self-control significantly differed between the two classes. In Class 2, the self-control among adolescents decreased over time, whereas among the adolescents in Class 1, self-control remained stable over time. The two classes showed no significant differences between the slopes of the other digital flourishing dimensions.

Predictors of trajectories

Table 4 displays the age, parental education (separately for father and mother), ethnicity, parental mediation style (i.e., controlling restrictive, autonomy-supportive restrictive, inconsistent restrictive, controlling active, and autonomy-supportive active mediation styles), and parental mobile and social digital skills by class. We investigated whether these variables predicted the probability of belonging to the trajectory of digital flourishing of Class 1 relative to Class 2.

Table 5 shows that the trajectories of digital flourishing of Class 1, compared with those of Class 2, did not vary by age, parental education, ethnicity, parental controlling and restrictive mediation style, and parental inconsistent restrictive mediation style. Nevertheless, adolescents whose parents implemented more autonomy-supportive restrictive, autonomy-supportive active, and

FIGURE 2 Average co-trajectory of digital flourishing dimensions by latent class, means by class. ASP, authentic self-presentation; CO, connectedness; CP, civil participation; PSC, positive social comparison; SC, self-control.

TABLE 4 Observed means and proportions of study variables by class.

	Class 1: High and stable digital flourishing		Class 2: Low digital flourishing and decreasing self-control	
	M/%	SD	*M*/%	SD
Age	15.28	1.749	15.37	1.774
Education father (low)	53.4		58.6	
Education mother (low)	34.6		38.6	
Ethnicity (majority)	82.6		78.3	
Parental mediation style				
Controlling restrictive	2.242	1.102	2.422	1.145
Autonomy-supportive restrictive	3.521	1.023	3.153	1.048
Inconsistent restrictive	2.524	1.008	2.667	0.944
Controlling active	3.326	0.912	3.126	0.936
Autonomy-supportive active	3.418	0.930	3.025	0.845
Parental digital skills				
Mobile	4.279	0.739	3.881	0.809
Social	4.332	0.655	4.000	0.755

Note: The variable parental education was coded as 1 = low education and 2 = high education; ethnicity was coded as 1 = ethnic majority background and 2 = ethnic minority background.

Abbreviations: *M*, mean; SD, standard deviation.

TABLE 5 Results of logistic regression, membership Class 1.

	Class 1: High and stable digital flourishing (reference category = Class 2: Low digital flourishing and decreasing self-control)		
	B	OR	95% CI
Age	−.039	0.961	[.880, 1.058]
Education father	.203	1.226	[.846, 1.775]
Education mother	.124	1.132	[.774, 1.658]
Ethnicity	−.353	0.703	[.461, 1.072]
Parental mediation style			
Controlling restrictive	−.166	0.847	[.664, 1.081]
Autonomy-supportive restrictive	.386**	1.472	[1.118, 1.938]
Inconsistent restrictive	−.254	0.776	[.597, 1.009]
Controlling active	.804***	2.235	[1.573, 3.174]
Autonomy-supportive active	.928***	2.529	[1.641, 3.896]
Parental digital skills			
Mobile	.651**	1.917	[1.310, 2.804]
Social	.449*	1.566	[1.062, 2.311]

Note: The variable parental education was coded as 1 = low education and 2 = high education; the ethnicity variable was coded as 1 = ethnic majority background and 2 = ethnic minority background.

Abbreviations: *B*, logit coefficient; CI, confidence interval; *n*, number of participants; OR, odds ratio.

*$p < .05$; **$p < .01$; ***$p < .001$.

controlling active mediation styles were more likely to belong to Class 1 than to Class 2 compared with adolescents whose parents applied less of the mentioned mediation styles. Moreover, higher parental mobile and social digital skills predicted a higher probability of belonging to Class 1 than to Class 2.

DISCUSSION

The present study focused on perceived positive digital communication and investigated the trajectories of digital flourishing dimensions in adolescence over the course of a year (RQ1). Two classes were identified, and each class had a relatively equal distribution of members. The adolescents in Class 1 reported significantly higher levels of digital flourishing than those in Class 2. Moreover, the level of positive social comparison among the adolescents in Class 1 increased over time. The remaining trajectories of digital flourishing dimensions among the adolescents in Class 1 remained stable over time. Among the adolescents in Class 2, self-control decreased and authentic self-presentation increased over time. Although we observe an increase in the slope of positive social comparison in Class 1 and an increase in the slope of authentic self-presentation in Class 2, these observed increases do not seem to differ between the classes. The classes only significantly differed in their overall levels of all digital flourishing dimensions and the decreased slope of self-control. The differences between the two classes suggest that the adolescents in Class 1 experienced more extensive digital flourishing and remained stable in flourishing their digital communication uses over time. In comparison, the adolescents in Class 2 flourished less in their digital communication, and their self-control over digital communication evolved worse than that of the adolescents in Class 1.

Several explanations may shed light on the observed trajectories of digital flourishing dimensions. The high levels of digital flourishing dimensions among the adolescents in "flourishing" Class 1 did not change over time; this stability might be attributed to the decrease in the average age of smartphone ownership among adolescents. The average age at which most children obtained their first smartphone in Slovenia in 2019 was eight (Primožič, 2020). Given that contemporary children obtain a smartphone at an early age, the most crucial formative years to develop positive digital experiences and behaviors are likely in preadolescence. This study did not consider the age at which the participants first acquired a smartphone. Prospective research could consider whether the early onset of smartphones differs across the two classes and relates to the early development of (stable) positive digital experiences of the "flourishing" class compared with the "less flourishing" class. The early age of smartphone acquisition (Primožič, 2020) together with the observed stability of adolescents' digital flourishing dimensions across 1 year in this study suggests that future research should further explore the digital user experiences of preadolescents. Potential interventions for flourishing digital communication may target younger, preadolescent groups if these groups appear to be crucial for developing digital flourishing.

Adolescents belonging to the "less flourishing" Class 2 had unequal levels of digital flourishing, and this inequality appears to grow stronger as their self-control over their digital communication decreases. Hence, self-control seems to be the digital flourishing dimension most at risk in adolescence. This finding is plausible, given that digital media offer users ubiquitous connectivity without time and place constraints (Vanden Abeele, 2021). As such, users face a mobile connectivity paradox and are caught between the autonomy that digital media offers and the loss of control over when and where to (dis)connect (Vanden Abeele, 2021). The distractive and so-called addictive design of digital media assures that some users find it difficult to resist their use and disconnect from them (Vanden Abeele, 2021). In our study, users who were increasingly challenged to balance connectivity and dysconnectivity appeared to belong to Class 2. Adolescents whose self-control over digital communication decreases over time seem to struggle to resist the temptations of digital communication use and fail to adaptively regulate their use. Additional observations are needed throughout a more extended period to learn if these adolescents' self-control continues to decrease over time and if this behavior results in problematic digital communication uses. Furthermore, prospective interventions could target adolescents of the "less flourishing" class by supporting them in learning to increase their self-control skills over digital communication.

The current study also investigated the predictors of the probability of belonging to the identified trajectories of digital flourishing. The results for the sociodemographic determinants—age, parental education, and ethnicity—were non-significant (RQ2–RQ4). In this study, age was used as a proxy for developmental changes. As adolescents grow older, their social, cognitive, and emotional skills increase (Berk, 2014). Although age often predicts various correlates in adolescence (Subrahmanyam & Šmahel, 2011), it did not explain adolescents' belonging to the two different digital flourishing trajectories identified in this study. This null finding may provide additional support for the notion that the development of positive digital experiences and behaviors occurs in preadolescence. Moreover, measuring the actual levels of social, cognitive, and emotional skills might allow to more accurately grasp the actual developmental changes among adolescents and better predict the trajectories of positive experiences and behaviors with digital communication than age.

A family's socioeconomic background and ethnic background have been well-established as determinants of access to digital communication (i.e., the first-level digital divide) (Helsper, 2020). More recent research on the digital divide has examined the digital skills and uses of digital communication (i.e., the second-level digital divide) and the outcomes of digital communication (i.e., the third-level digital divide) and found that sociodemographic variables are inconsistent predictors of differences on digital divide (Helsper, 2020). Moreover, the digital divide literature has mainly focused on the predictors of tangible skills (e.g., technical-operational skills) and negative tangible outcomes (e.g., worse academic performance) (Bohnert & Gracia, 2022) and neglected social digital skills and subjective positive outcomes (e.g., connectedness with online networks) (Büchi et al., 2018). The current study helped to address these gaps in the literature and found that sociodemographic determinants are poor predictors of the inequalities in adolescents' perceived digital communication skills and related positive outcomes (i.e., digital flourishing).

Whereas the sociodemographics of one's parents seem to be less informative in this area of research, how skilled the parents are in their digital uses and whether and how parents support their children to positively communicate online are important. According to our study, adolescents whose parents used more autonomy-supportive restrictive, autonomy-supportive active, and controlling active parental mediation styles likely belonged to Class 1, which had relatively high levels of digital flourishing compared with Class 2 that exhibited low levels of digital flourishing and, in particular, a decreasing level of self-control (RQ5). Hence, all forms of active mediation (Livingstone et al., 2015) and both autonomy-supportive active and autonomy-supportive restrictive mediation styles (Valkenburg et al., 2013) stimulated positive

experiences and behaviors with digital communication among adolescents.

Parents using active mediation and autonomy-supportive mediation styles guide their children by providing a convincing rationale for their requests regarding digital communication; respect their children's choices, perspectives, and feelings; encourage initiatives; and support their children to make choices when they are developmentally mature enough (Valkenburg et al., 2013). Such mediation styles that avoid interfering with and controlling adolescents' digital communication use and support adolescents' autonomy over digital communication with their peers are also known to contribute to a higher quality of parent–adolescent relationships (Shapka, 2019). Previous research has further demonstrated that the frequency of parent–child discussions about the tendency of social media users to present favorable self-images on social media (i.e., the positivity bias) increased critical awareness of the positivity bias among adolescents over time (Schreurs & Vandenbosch, 2023). Such awareness was also one of the digital flourishing dimensions studied here. Our findings additionally support parents' important role in adolescents' positive experiences with digital communication. Interestingly, the controlling restrictive and inconsistent restrictive parental mediation styles appeared as non-determinative, as these mediation styles did not predict the probability of belonging to Class 2.

Our results further indicated that higher parental mobile and social digital skills predicted a higher probability of belonging to the "digitally flourishing" Class 1 compared with the "less flourishing" Class 2 (RQ6). This result supports the notion that parents are important socialization agents for contemporary adolescents' digital communication patterns. Parents with higher digital skills are more likely to recognize digital opportunities for their children (Katz et al., 2019). Such opportunities may include online connectedness, authentic self-presentation and avoiding positivity bias, inspiration during online social comparisons, civil digital communication, and self-control over digital communication. Hence, parents must seek knowledge of the positive uses of digital communication, gain and maintain their digital skills, and guide their children's digital communication uses in an active and autonomy-supportive manner. This will likely give adolescents a feeling of being understood and make them less reluctant toward parental mediation attempts (Shapka, 2019). Adolescents could also see their parents as competent digital communication users and more easily seek support from them regarding their digital uses (Nelissen & Van den Bulck, 2018).

Our study findings present several practical implications. So far, digital literacy interventions have mainly considered teaching tangible technical-operational, information-navigation, content-creation skills, and social-communicative digital skills (Scheerder et al., 2017) and focused on mitigating the negative outcomes of digital communication (e.g., exposure to undesired content, cyberbullying, and smartphone addiction) (Boer et al., 2022; D'Haenens & Ogan, 2013; Erreygers et al., 2018). Our study highlighted the need to prioritize the rarely considered perceived positive outcomes of digital communication (such as digital flourishing) in interventions. Different trajectories in adolescents' digital flourishing over time suggest avoiding "one-size-fits-all" type of interventions and considering person-specific fluctuations throughout adolescence when developing positive digital communication interventions. The adolescents who remain digitally flourishing over time require interventions to do so, whereas those who follow a trajectory with lower levels of digital flourishing and diminishing self-control over digital communication use over time need interventions to increase their overall levels of digital flourishing and to prevent their decreasing self-control over time. Interventions tailored to users' individual needs could also consider that fluctuations in digital flourishing are susceptible to a user's environment. Parents could be targeted as training agents, as they seem to contribute to an increasing digital flourishing trajectory by implementing active mediation and autonomy-supportive mediation styles and by possessing higher mobile and social digital skills. The existing training interventions targeting parents' digital literacy can pay more attention to parents with lower digital skills, as these parents seem to provide their children with fewer opportunities to flourish digitally. Close monitoring of whether such interventions are successful is important.

Limitations and future research

Some limitations of this study should be noted. First, the current longitudinal study was conducted over a 1-year period and included three measurement points. This time frame was selected based on previous research on media effects (Schreurs et al., 2023), as theoretical guidance is missing. Drawing on previous studies exploring the changes in adolescence (Boer et al., 2022; Ratelle & Duchesne, 2014), a longer study conducted over the entire course of adolescence to obtain data at more than three measurement points may offer a more comprehensive understanding of the changes in the trajectories of digital flourishing dimensions. Four-wave panel data would allow us to estimate quadratic growth parameters. Such data could further explain whether the trajectories of digital flourishing dimensions among adolescents in Classes 1 and 2 indeed remain stable over time and whether the decrease in self-control in Class 2 is strictly linear or stabilizes over time.

Second, the model with two classes was the most optimal solution in our sample. A three-class solution also

seemed appropriate. However, this model was rejected mainly owing to its very small sample size of the third class (i.e., less than 5% or 50 participants), which might be attributable to our sample still not being sufficiently diverse. Future research may strive to consider a larger sample to determine whether the three-class solution would result in more adolescents belonging to the third class (see Supporting Information S3 for model estimates of a three-class solution). In addition, by adopting LCGA, complete homogeneity in the two classes of digital flourishing development was assumed. However, substantial heterogeneity may exist in how adolescents digitally flourish over time within the classes; nevertheless, allowing for this heterogeneity in our analyses resulted in convergence problems. Larger samples are thus also needed to test more complex models such as GMM that account for heterogeneity within subgroups of adolescents.

Third, the representativeness of the findings may be limited. The present study only assessed the trajectories of Slovenian adolescents. These trajectories may differ from those of adolescents from other cultures, as the perceptions of positive digital experiences differ across countries of the Global North and Global South (Ernala et al., 2022). Moreover, boys, ethnic minority adolescents, and older adolescents were more likely to drop out of the study. Similar missing data patterns have occurred in other longitudinal studies of digital media use among adolescents (e.g., Erreygers et al., 2018; Schreurs et al., 2023) and have implications for the generalizability of the findings. Our data were also not MCAR, as missing data differed according to adolescents' gender (Gelman & Hill, 2007). Following Erreygers et al. (2018), we retained all participants in our sample to limit potential bias related to missingness and dropout. We used the FIML estimator, which efficiently handles missingness patterns under the assumption of missing data at random (Enders, 2001). Prospective longitudinal studies on the trajectories of digital flourishing dimensions may strive to motivate those who are likely to drop out to stay in the study.

Fourth, we measured adolescents' SES based on the level of parental education. This typically used measure could be supplemented with other measures of family SES, such as family income and parental occupation (Ren et al., 2022). Such SES measures might provide a more accurate picture of an adolescent's actual SES and, thus, potentially better predict the digital flourishing trajectories.

Fifth, parental mediation and digital skills were assessed at T2. Previous studies have demonstrated that adults' digital skills remain relatively stable if they do not experience an intervention (Alt & Raicher, 2020), and active parental mediation has been shown to be stable over a 1-year period (Schreurs & Vandenbosch, 2023). Measuring parental behavior at all time points could have potentially provided a more comprehensive view. Moreover, an established instrument with a single item per parental mediation style was used (Meeus et al., 2019; Valkenburg et al., 2013). Future research may consider more extensively measuring a dynamic concept such as parental mediation style and developing a multiple-item measurement instrument.

Sixth, this study included self-reported measures of digital flourishing and its (potential) predictors. Thus, here digital flourishing reflects adolescents' self-perceptions and not the actual positive effects of digital communication (Janicke-Bowles et al., 2023). The mean values for the civil participation and self-control dimensions were high, as adolescents might have provided socially desirable answers. However, no ceiling effect occurred, as less than 15%–20% of the respondents scored the highest value on the digital flourishing variables, and the data were normally distributed. Moreover, parental education, ethnicity, parental digital skills, and parental mediation styles reflect adolescents' subjective assessments and might be misreported (Ehrenreich et al., 2021). Nevertheless, such subjective assessments are a standard practice when acknowledging a child's perspective in research (e.g., Valkenburg et al., 2013). Harman's single-factor test further showed that common method bias was absent in our study (Podsakoff et al., 2003).

Finally, as users often simultaneously perceive positive and negative experiences of digital communication (Vanden Abeele, 2021), future research should consider whether users who report (mainly) negative experiences of digital communication have slower growth in digital flourishing trajectories.

In sum, despite having some limitations, the present study revealed that a part of adolescents appear to flourish digitally and keep flourishing over time, whereas others seem to flourish less digitally and their self-control over digital communication decreases over time. Parents can stimulate adolescents' digital flourishing by using autonomy-supportive and active mediation practices to guide adolescents' digital communication uses and by modeling their own mobile and social digital skills.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data necessary to reproduce the analyses presented here are publicly accessible. Data are available at the following URL https://osf.io/h3z6d/. The analytic code necessary to reproduce the analyses presented in this paper

is publicly accessible. The code is available at the following URL https://osf.io/h3z6d/. The materials necessary to attempt to replicate the findings presented here are publicly accessible. Materials are available at the following URL: https://osf.io/h3z6d/. The analyses presented here were preregistered. The preregistration is available at the following URL: https://osf.io/wcuys.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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