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Gendered perspectives on digital skills and digital activities: Comparing non-binary and binary youth

Perspectivas de género sobre habilidades y actividades digitales: Comparación entre jóvenes no binarios y binarios

Dr. David De Coninck. Postdoctoral Researcher, Centre for Sociological Research, KU Leuven, Leuven (Belgium) (david.deconinck@kuleuven.be) (https://orcid.org/0000-0003-3831-266X)
Dr. Leen d'Haenens. Professor, Institute for Media Studies, KU Leuven, Leuven (Belgium) (leen.dhaenens@kuleuven.be) (https://orcid.org/0000-0001-7847-9996)

ABSTRACT

Previous research on gender differences in young people's digital development has shown that boys and girls differ in frequency and type of internet use, but vital gaps in the literature remain. In recent years, gender is increasingly considered to be a multidimensional concept with a growing number of young people identifying as non-binary (i.e. genderfluid, an umbrella term for gender identities that are not conforming to the male/female dichotomy). Non-binary youth more frequently engage with a variety of digital risks such as misinformation, cyberbullying, and co-rumination than binary youth. Despite this, no research so far has investigated how digital development differs between non-binary and binary youth. In this online survey study among adolescents in six European countries (N=6,221), we focus on differences in digital skills and digital activities. Non-binary youth tend to make greater use of the internet for content creation and mental and physical health information than boys and girls. They also report greater content creation skills than boys and girls. Disparities in terms of entertainment and social relationship use are also found. Furthermore, findings on digital skills indicate that non-binary youth closely mirror boys in this regard. We conclude with recommendations for future research that should help bolster our understanding of how digital contexts may predict the development and well-being of non-binary youth.

RESUMEN

Investigaciones previas sobre las diferencias de género en el desarrollo digital de los jóvenes han demostrado que los chicos y las chicas difieren en la frecuencia y el tipo de uso de Internet, donde todavía existen lagunas vitales en materia literaria. En los últimos años, el género se considera cada vez más un concepto multidimensional, con un número creciente de jóvenes que se identifican como no binarios (es decir, «genderfluid», un término que engloba las identidades de género que no se ajustan a la dicotomía hombre/mujer). Los jóvenes no binarios se enfrentan con más frecuencia que los binarios a diversos riesgos digitales como la desinformación, el ciberacoso y la co-rumiación. A pesar de esto, hasta ahora ninguna investigación ha estudiado cómo el desarrollo digital difiere entre los jóvenes no binarios y binarios. En este estudio de encuesta en línea entre adolescentes de seis países europeos (N=6.221), nos centramos en las diferencias en las habilidades y actividades digitales. Los jóvenes no binarios tienden a hacer un mayor uso de Internet para la creación de contenidos y la información sobre salud mental y física que los chicos y las chicas. También declaran tener más habilidades de creación de contenidos que los chicos y las chicas. También se encuentran disparidades en cuanto al uso del entretenimiento y las relaciones sociales. Además, los resultados sobre las habilidades digitales indican que los jóvenes no binarios se asemejan mucho a los chicos en este aspecto. Concluimos con recomendaciones para futuras investigaciones que deberían ayudar a reforzar nuestra comprensión de cómo los contextos digitales pueden predecir el desarrollo y el bienestar de los jóvenes no binarios.

KEYWORDS | PALABRAS CLAVE

Non-binary, gender, young people, digital skills, LGBTQ, digital activities.
No binario, género, jóvenes, competencias digitales, LGBTQ, actividades digitales.

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1. Introduction

Recently, children and young people are spending an increasing amount of time in digital environments. It has become one of their key leisure activities (Livingstone et al., 2018; Pokhrel & Chhetri, 2021). Young people's identities are also increasingly constructed through, and intertwined with, digital environments. In spite of the growing importance of digital technologies, not all children and young people use them in the same way (Bloemen & De-Coninck, 2020; Mascheroni & Ólafsson, 2016; Vissenberg & d'Haenens, 2020). With this in mind, some 'digital natives' are more fluent with regard to certain digital skills and activities than others (Haddon et al., 2020; Livingstone et al., 2018). Yet, in contemporary societies, in which an increasing number of services and activities are taking place online, such skills and activities seem more important than ever before. Despite the rapidly growing literature on digital skills and activities among youth, important gaps remain.

A key gap in this regard is related to gender identity. In previous years, several studies have looked at the differences between men and women in terms of internet use, digital literacy, and digital activities (Singh, 2001; Tian et al., 2021). These have shown that women use the internet for different reasons than men and that digital skills are more developed among men. However, the use of gender identity as a binary construct (female/girl-male/boy) is quickly becoming outdated. Increasingly, gender is considered to be multidimensional, with growing numbers of individuals reporting to be non-binary or genderfluid (i.e. an umbrella term for gender identities that are not conforming to the male/female dichotomy) (Craig & McInroy, 2014). Clark et al. (2018: 159) describe them as "typically experienc[ing] gender in a way that does not always or ever align with the sex assigned to them at birth. For example, a person who is genderfluid may shift between genders, while someone who is genderqueer may experience gender in a way that is not part of the gender binary". Although the literature on non-binary youth is quickly developing, most of it has focused on mental and physical health vulnerabilities or disparities with their binary counterparts (Hatchel et al., 2017). To our knowledge, no studies have investigated digital inequalities between binary and non-binary youth. This is somewhat surprising, especially given the growing link between youth' identity formation and the digital environment. Lesbian, gay, bisexual, transgender, and questioning (LGBTQ) youth have been found to retreat into digital environments to compensate for a lack of supportive face-to-face connections (Craig & McInroy, 2014), which may have a number of repercussions for their digital risks, digital skills, and physical and mental health outcomes (Mascheroni et al., 2022; Valkenburg et al., 2006). Given previous findings that indicate that non-binary youth are significantly more at risk of depression and suicide than binary youth – with peer and family support structures acting as key moderators – (Clark et al., 2018; Hatchel et al., 2021a), it is important to investigate how their digital skills and activities differ from their binary counterparts. The lack of academic research on this topic – and on non-binary youth more generally in the communication sciences – is problematic as it results in little information for policymakers on which to base best practices for digital risks and opportunities (Hatchel et al., 2021b).

With this study, we provide a first investigation into differences in digital skills and activities between non-binary and binary youth. Using online survey data collected among children and young people aged 11 to 20 between April and November of 2021 in six European countries[1] (Estonia, Finland, Germany, Italy, Poland, Portugal, N=6,221), we study to what extent five dimensions of youth digital skills (technological and operational skills, programming, information navigation and processing, communication and interaction, content creation and production) and five dimensions of digital activities (online learning, social relationships, entertainment, content creation, health use) differ based on gender identity (boy, girl, other). Furthermore, we also look at how peer support, family support, and self-efficacy of non-binary youth are linked to their digital skills and activities.

1.1. Literature review

A number of studies have looked at the role of gender to understand disparities in internet use and digital skills. Although many of these studies have been conducted on limited samples of high school or college students, reviews that also include adult samples indicate that men appear to be more likely to exhibit problematic internet use than women (Baloglu et al., 2020; Morahan-Martin, 1998). Men and

women also engage in digital environments for different reasons. When focusing on youth, we also find gender differences in the ways they use the Internet (Herring & Kapidzic, 2015). Livingstone and Bovill (1999) showed in the late 20^{th} century that boys used computers more often than girls and felt more comfortable doing so. However, these gender differences disappeared quickly, and by 2004, boys and girls utilized the internet equally to communicate with peers. In the late 2000's, girls surpassed boys as the most frequent internet users, largely fuelled by the growth of social media platforms (Lenhart et al., 2007). These new media were – and continue to be – more commonly used by girls than boys to communicate with peers and to create and share videos (Lenhart, 2012). Boys were more likely to use these technologies for entertainment (e.g., gaming) and visit video websites like YouTube (Rideout et al., 2010).

The digital development of non-binary youth has not received much attention in Europe. In the United States, evidence from 2013 shows that LGBTQ youth spend an average of 5 hours per day online; approximately 45 minutes more than reported by non-LGBTQ youth (GLSEN et al., 2013; Hatchel et al., 2021b). This is not entirely surprising: The Internet (and, more specifically, social media) has quickly evolved into an arena that provides LGBTQ youth an opportunity to safely construct and develop their sexual and gender identity, interact with people from their community, and establish connections with likeminded individuals – all of which may be absent in their face-to-face relationships (Lucero, 2017). A recent large-scale survey study in the United States and Canada confirms that LGBTQ youth are highly active on the Internet and report high usage of new ICTs (McInroy et al., 2019a). Additionally, it also reports that they are more likely to participate in online than offline LGBTQ communities due to heightened feelings of safety and increased emotional support (McInroy et al., 2019b). However, this greater internet use is also related to a variety of (digital) risks, most notably through cyberbullying, misinformation, sharing and receiving sexually explicit images, and meeting up with online contacts (Hatchel et al., 2021b; Sousa et al., 2020). Recent data indicates that about one-third of LGBTQ youth report being a victim of cyberbullying, either due to their gender identity or their sexual orientation. Varjas et al. (2013) found that those who reported cyberbullying victimization also had a greater likelihood of being victimized by face-to-face bullying. Regarding misinformation, it has been reported that online resources and social media that were regularly consulted by transgender youth (e.g., Tumblr) for health concerns or LGBTQ rights often contain considerable misinformation regarding these topics. While this is problematic for all youth, this is particularly the case for LGBTQ youth given their reliance on online resources for psychoeducation about their gender or sexual development (Hatchel et al., 2021b).

Co-rumination is a final risk that we review here. It is defined as "excessively discussing personal problems within a dyadic relationship and is characterized by frequently discussing problems, discussing the same problem repeatedly, mutual encouragement of discussing problems, speculating about problems, and focusing on negative feelings" (Rose, 2002: 1830), and it is considered common among LGBTQ youth in digital settings. Although outcomes of co-rumination are not exclusively negative – it has been known to increase friendship quality –, the normalization of mental health problems like depression, anxiety, and suicide that result from it outweigh its positive outcomes (Meyer et al., 2015). These risks – along with other factors – are linked to poor mental health, psychological distress, and suicidal ideation among LGBTQ youth (Hatchel et al., 2021b), with rates that are considerably higher than those of non-LGBTQ youth. Given these youth's reliance on digital environments and the risks that are associated with their frequent use of these sources, more research into protective factors against such risks is pivotal among LGBTQ youth. In this regard, various studies have highlighted the role of digital skills (Livingstone et al., 2021; Rodríguez-de-Dios & Igartua, 2016). Youth is expected to be able to avoid the negative outcomes of digital technologies by acquiring digital skills (Rodríguez-de-Dios & Igartua, 2016). However, recent evidence suggests that the relationship between risks and skills is not straightforward. In their systematic evidence review, Livingstone et al. (2021) showed that digital skills were indirectly linked to greater exposure to digital risks. They also found a positive link between skills and online opportunities, information benefits (of particular importance to LGBTQ youth), and orientation to technology.

Regarding Livingstone et al.'s (2021) conflicting results on the relationship between digital skills and digital risks, they did find that specific subsets of skills were linked to lower exposure to digital risks. For example, technical skills were linked to mixed or even negative outcomes, while information skills were

linked to positive outcomes (Livingstone et al., 2021). Contemporary understandings of digital skills dictate that it is a multidimensional concept, consisting of five subdimensions: (1) technical/operational skills; (2) programming; (3); information navigation; (4) communication and interaction; (5) content creation and production (Helsper et al., 2020). These various skills are linked to outcomes in different ways, as illustrated by Livingstone et al. (2021). In addition to outcomes, a number of key antecedents of digital skills have also been identified. An important hypothesis here is the recursive loop hypothesis which suggests that specific socio-psychological and structural factors may reinforce digital inequalities and disparities, which, in turn, negatively affect these factors (Robinson et al., 2020). We focus on the role of peer and family support and self-efficacy. Peer and familial support structures have been found to be of key importance to LGBTQ youth's well-being (Fish et al., 2020; Hatchel et al., 2017), but also to the development of digital skills among youth in general (Mascheroni et al., 2022).

1.2. The present study

This article provides a first investigation of the development of digital skills and digital activities of non-binary youth, comparing these with those of binary youth. Currently, there is a dearth of research on non-binary youth (McInroy et al., 2019a). The few studies that do exist focus mostly on mental or physical health outcomes of these youth. However, as the LGBTQ community grows, it becomes increasingly important to include specific studies on these youths in other areas of social and psychological sciences that are not specifically related to their gender or sexual identity. Not doing so would yield an incomplete picture of the social reality of contemporary societies, particularly for young people.

In this study, we focus on the digital development of non-binary youths. This is directly relevant to this group, as studies have shown they spend significantly more time online and use the internet differently than boys and girls, while also being confronted with a number of digital risks which negatively contribute to their mental health (McInroy et al., 2019a, 2019b). Digital skills are hypothesized to be a key protective factor against such digital risks. Our expectations are twofold. On the one hand, given that LGBTQ youth spend more time online than non-LGBTQ youth (McInroy et al., 2019a), we may expect that their digital skills are more developed. On the other hand, a lack of digital skills may be one of the reasons why these youths are frequently confronted with digital risks. In sum, we seek to answer the following research question:

- RQ1. How do digital skills and digital activities differ between non-binary and binary youth?

With regard to mental health and internet use, more empirical evidence exists – particularly from studies in the United States. LGBTQ youth are known to report high rates of poor mental health, psychological distress, and suicidal ideation (Hatchel et al., 2021b). It is unclear to what extent these adverse mental health outcomes are linked to their internet use, but as well, evidence indicates that LGBTQ youth spend more time online than non-LGBTQ youth – up to 45 minutes per day more on average (GLSEN et al., 2013). To confirm these more well-known insights for the current sample, we test two hypotheses:

1) Non-binary youth report greater internet use than binary youths (Hypothesis 1).

2) Non-binary youth report lower well-being than binary youth (Hypothesis 2).

Because the literature on non-binary youth is scant, we are unable to develop clear hypotheses for the link between well-being and internet use for this group. Thus, we also develop an additional research question regarding the link between well-being and internet use:

- RQ2: How is well-being linked to internet use among non-binary youth?

In line with the recursive loop hypothesis, we believe that digital skills and digital activities may be reinforced by certain socio-psychological and structural factors. Three factors that we examine are peer support, family support, and self-efficacy because of their relevance in both, digital skills and LGBTQ literature (Mascheroni et al., 2022). Because it is unclear to what extent these factors are related to digital skills and digital activities among non-binary youth, a third research question is:

- RQ3. How are digital skills and digital activities linked to support structures and self-efficacy?

2. Materials and methods

2.1. Data

We distributed an online questionnaire to children and young people aged 11 to 20 in six European countries (Estonia, Finland, Germany, Italy, Poland, and Portugal) between April and November 2021 (N=6,221)[2]. The data were collected in collaboration with secondary schools. We used a convenience sampling design, although schools were selected based on their socioeconomic status to ensure the diversity of participants. We contacted and informed schools about the study. A total of 52 schools agreed to participate, with 460 classes participating in total. Researchers were present during the data collection in each class, either in person or digitally, due to school closings during the COVID-19 pandemic. Informed consent was obtained from all participants and their legal guardians. The questionnaire was identical across all countries and it was presented in the official language of each country. Translations were carried out by professionals.

2.2. Measures

- Gender: To assess respondents' gender identity, we asked to what extent they identified as: (1) boy, (2) girl, (3) non-binary.
- Digital skills: We used the youth Digital Skills Indicator (yDSI), a validated cross-cultural scale that measures five dimensions of digital skills: (1) technical and operational skills; (2) programming; (3) information navigation and processing; (4) communication and interaction; (5) content creation and production. It was developed to capture key elements of functional (ability to use ICTs) and critical (understanding ways how ICTs are designed, and content is produced) digital skills (Helsper et al., 2020); 25 items were used to measure digital skills. A sample item was 'I know how to turn off the location settings on mobile devices', and answer options ranged from 1 (not at all true of me) to 5 (very true of me). Programming was measured through a single item, the other skill dimensions, each measured using six items, had high reliability in the current sample (technical and operational: .74; information navigation and processing: .80; communication and interaction: .77; content creation and production: .79). The full scale can be found in Helsper et al. (2020).
- Digital activities: We presented participants with 11 items to assess five different types of digital activities: (1) online learning; (2) social relationships; (3) entertainment; (4) content creation; (5) health use. A sample item was 'I used the internet to search or follow news about local, social, environmental, or political issues', and answer options ranged from 1 (never) to 6 (almost all the time). The specific wording of the items can be found in Table 1.
- Internet use: We included an indicator regarding the time spent on the Internet during a regular weekday, with answer options ranging from 1 (little to no time) to 9 (about 7 hours or more).
- Well-being: Well-being was assessed through six items that asked whether participants felt happy, pleased with the way they were, felt that life was enjoyable (positive dimension), felt dissatisfied with life, felt cheerless, and felt that life was meaningless (negative dimension), in the past year. Answer options ranged from 1 (never) to 4 (often). These six items were aggregated into a positive dimension and a negative dimension.
- Peer support and family support: Peer and family support were each measured through three items. Items that assessed peer support were 'My friends really try to help me', 'I can count on my friends when things go wrong', 'I can talk about my problems with my friends'. Items that assessed family support were 'When I speak someone listens to what I say', 'My family really tries to help me', and 'I feel safe at home'. For these items, answer options ranged from 1 (not true) to 4 (very true).
- Self-efficacy: This construct was measured through a four-item scale developed by Schwarzer and Jerusalem (1995). A sample item was: 'It's easy for me to stick to my aims and achieve my goals'. The response scale ranged from 1 (not true) to 4 (very true).An overview of the full sample can be found below, and the sample by country can be found in Table 2.

Table 1. Descriptive overview of the sample (N=6,221)	
In %	
Gender	
Cisgender male (n=3,119)	50.2
Cisgender female (n=2,991)	48.1
Non-binary (n=106)	1.7
Mean scores (SE in brackets)	
Age	14.50 (1.38)
Digital skills (1–5)	
Technical/operational	4.21 (0.74)
Programming	2.32 (1.30)
Information navigation/processing	3.94 (0.76)
Communication/interaction	4.48 (0.56)
Content creation/production	3.90 (0.85)
Digital activities (1–6)	
Online learning	2.62 (0.94)
Social relationships	3.56 (0.95)
Entertainment	4.08 (1.16)
Content creation	2.18 (1.33)
Health use	1.90 (1.04)
Online learning	2.62 (0.94)
Peer support (1–4)	3.24 (0.73)
Family support (1–4)	3.50 (0.60)
Self-efficacy (1–4)	2.94 (0.65)
Well-being (1–4)	
Positive dimension	3.37 (0.69)
Negative dimension	2.41 (0.89)
Internet use (1–9)	5.96 (1.98)

2.3. Data analysis

We conducted a Pearson correlation analysis between relevant variables for non-binary youth, and boys and girls (Table 3). In this and the following analyses, we chose not to distinguish by country for two reasons. First, as argued by Gui and Argentin (2011: 964), "among today's teenagers in Western countries differences in terms of physical access [to the Internet] are almost irrelevant. Nowadays, schools are increasingly offering an internet connection so that access is free and easily available for many high school and college students. In some areas the binary divide between the haves and have-nots no longer applies to young people". To further support this, Eurostat (2020) indicates that 94% of young people in the EU-27 made daily use of the internet in 2019. Second, the share of non-binary youth was low (under 4%) in all countries. Splitting the analysis by country would further fragment the limited share of non-binary youth which would endanger the robustness of findings of country differences in these analyses. Furthermore, no non-binary youth were included in the Portuguese sample.

In the first step, we ran a one-way analysis of variance to study whether digital skills, activities, internet use, and well-being significantly differed between boys (n=3,119), girls (n=2,991), and non-binary youth (n=106). This analysis provides an answer to the main research question of how digital skills and activities differ between binary and non-binary youth, and to the hypotheses regarding well-being (H1) and internet use (H2). Subsequently, we ran ten linear regression analyses with the five digital skills and five digital activities as dependent variables, and selected socio-psychological and support variables as independent variables to provide an answer to RQ2. To reduce the odds of Type II error resulting from the small sample size for non-binary youth (n=106), we applied a 1,000-sample bootstrapping method. This has been shown to be an effective statistical procedure that reduces the standard error of parameters under the condition requiring both acceptable confidence intervals and confidence levels (Chernick, 2011).

3. Results

To provide an answer to RQ1 about the difference in digital skills and digital activities between non-binary and binary youth, we look to the findings of the ANOVA in Table 2. Regarding digital skills, we found that non-binary youth's skill level closely aligns with that of boys for four out of five digital skills. However, they did report significantly greater technical/operational ($M_{non-binary}$=4.32 vs. M_{girls}=4.05), programming ($M_{non-binary}$=2.54 vs. M_{girls}=2.12), and information navigation skills ($M_{non-binary}$=4.03 vs. M_{girls}=3.78) than girls. As for content creation and production, non-binary youth reported a significantly higher skill level (M=4.21) than either boys (M=3.95) or girls (M=3.84). In terms of digital activities, non-binary youth (M=3.70) engaged with the internet significantly more than boys (M=3.45) to develop social relationships, and significantly more than girls ($M_{non-binary}$=4.50 vs.

M_{girls}=3.83) for entertainment purposes. Non-binary youth also used the internet more for content creation (M=2.83) than either boys (M=2.24) or girls (M=2.08). Finally, results also indicate that non-binary youth (M=2.62) make greater use of the internet to look up information regarding mental and physical health than boys (M=1.73) and girls (M=2.05).

To provide an answer to hypothesis 1, in which we expected non-binary youth to report greater internet use than non-binary youth, we found that non-binary youth scored 6.95 out of a possible 9 on internet use, while boys and girls scored 5.78 and 6.11, respectively – thus, confirming hypothesis 1. For hypothesis 2, we expected that non-binary youth reported lower well-being than binary youth. Here, findings indicate that non-binary youth reported higher scores on the negative dimension of well-being ($M_{non-binary}$=3.02 vs. M_{boys}=2.16, M_{girls}=2.64) and lower scores on the positive dimension of well-being (M=2.63) than either boys (M=3.54) or girls (M=3.23). These results confirm hypothesis 2. Regarding the link between internet use and well-being among non-binary youth, we briefly turn to the results of the Pearson correlation analysis in Table 3. Here, the correlation between dimensions of well-being and internet use were not statistically significant for non-binary youth, while there was a strong significant link among binary youth – providing an answer to the second research question.

Table 2. Analysis of variance of skills, well-being, internet use, and digital activities by gender

	F-value	p-value	Mean scores (SD)		
			Boy (n=3,119)	Girl (n=2,991)	Non-binary (n=106)
Digital skills					
Technical/operational	134.253	.000	4.36 (0.71)	4.05** (0.74)	4.32 (0.76)
Programming	24.486	.000	2.49 (1.34)	2.12** (1.22)	2.54 (1.40)
Information navigation/processing	133.658	.000	4.09 (0.74)	3.78** (0.75)	4.03 (0.75)
Communication/interaction	1.678	.187	4.46 (0.59)	4.49 (0.52)	4.48 (0.69)
Content creation/production	18.962	.000	3.95** (0.88)	3.84*** (0.82)	4.21 (0.77)
Digital activities					
Online learning	3.047	.048	2.60+ (0.95)	2.64 (0.92)	2.81 (1.02)
Social relationships	37.284	.000	3.45* (0.98)	3.67 (0.92)	3.70 (0.84)
Entertainment	144.876	.000	4.32 (1.14)	3.83*** (1.12)	4.50 (1.02)
Content creation	21.102	.000	2.24*** 1.37)	2.08*** (1.27)	2.83 (1.59)
Health use	92.320	.000	1.73*** 0.97)	2.05*** (1.06)	2.62 (1.28)
Online learning	3.047	.048	2.60+ (0.95)	2.64 (0.92)	2.81 (1.02)
Well-being					
Positive dimension	193.830	.000	3.54*** 0.61)	3.23*** (0.70)	2.63 (0.88)
Negative dimension	233.944	.000	2.16*** 0.84)	2.64*** (0.86)	3.02 (0.97)
Internet use	29.220	.000	5.78*** 1.96)	6.11*** (1.99)	6.95 (1.84)

Note. p+<.10; p*<.05; p**<.01; p***<.001. Asterisks indicate if significant differences were found between scores of boys/girls and non-binary youth based on Tukey post-hoc testing. Significant differences between boys and girls are not indicated here.

To provide an answer to the third research question, about how digital skills and digital activities are linked to support structures and self-efficacy among non-binary youth, we look at the results of the linear regression analyses in Table 3 and Table 4.

Table 3. Multinomial regression of digital skills and peer support, family support, and self-efficacy

	T/O		P		IN&P		C&I		CC&P	
	β	p	β	p	β	p	β	p	β	p
Non-binary										
Peer support	-.236	.206	-.278	.101	-.150	.305	-.139	.345	-.336	.027
Family support	.183	.397	.284	.140	.090	.615	.275	.123	.180	.295
Self-efficacy	.237	.097	-.135	.404	.243	.076	.221	.108	.292	.047
R^2	.044		.025		.012		.090		.087	
Boy										
Peer support	.080	.000	.016	.494	.075	.001	.098	.000	.060	.007
Family support	-.010	.640	-.051	.025	-.024	.267	.058	.007	-.035	.104
Self-efficacy	.207	.000	.083	.000	.264	.000	.222	.000	.257	.000
R^2	.057		.006		.082		.086		.073	
Girl										
Peer support	.062	.008	-.070	.003	.009	.679	.105	.000	.063	.006
Family support	-.112	.000	-.053	.026	-.103	.000	-.035	.132	-.130	.000
Self-efficacy	.196	.000	.076	.001	.277	.000	.224	.000	.220	.000
R^2	.040		.009		.067		.067		.050	

Note. T/O=technical and operational skills; P=programming; IN&P=information navigation and processing; C&I=communication and interaction; CC&P=content creation and production. Skills scores range from 1 (low skill) to 5 (high skill). 1000 bootstraps.

Support structures and self-efficacy only seem moderately related to digital skills among non-binary youth. Greater (real-life) peer support was related to lower content creation skills (β=-.336, p=.027), while greater self-efficacy was linked to greater content creation skills (β=.292, p=.047). Particularly, the former effect is notable: a small positive effect between peer support and content creation skills was found

among boys and girls. This may indicate that boys and girls create content to share and interact with their (face-to-face) friends in digital settings (e.g., creating memes about events at school), while non-binary youth may create content mainly to share with strangers or publicly post on digital platforms, without a specific link to their face-to-face friends.

For digital activities, we saw that self-efficacy was linked to greater internet use for online learning activities (β=.502, p=.007) and the development of social relationships (β=.349, p=.026). While these effects of self-efficacy were also found among boys and girls, they were much stronger for non-binary youth. Although it is impossible to make claims regarding the direction of this relationship based on these cross-sectional data, fostering self-efficacy among non-binary youth may thus indirectly also strongly benefit their tendency to inform themselves about the world and engage with others in digital settings. We also found that family support was negatively linked to using the internet to look up health information (β=-.374, p=.036), in line with findings from boys and girls – but again, with a much stronger effect among non-binary youth. Having support from one's family may encourage non-binary youth to discuss their health problems with their family rather than look up information online.

Table 4. Multinomial regression of digital activities and peer support, family support, and self-efficacy

	Online learning		Social relationships		Entertainment		Content creation		Health use	
	β	p	β	p	β	p	β	p	β	p
Non-binary										
Peer support	.035	.817	.091	.592	.057	.729	-.199	.248	-.004	.992
Family support	-.482	.005	-.315	.077	-.056	.766	-.072	.772	-.374	.036
Self-efficacy	.502	.002	.349	.026	-.068	.702	.113	.514	.076	.615
R^2	.177		.054		.023		.012		.064	
Boy										
Peer support	.007	.765	.126	.000	.060	.008	.041	.074	.006	.788
Family support	-.028	.218	-.006	.787	-.020	.371	-.114	.000	-.159	.000
Self-efficacy	.131	.000	.065	.003	.050	.021	.096	.000	.068	.002
R^2	.015		.023		.006		.016		.023	
Girl										
Peer support	.005	.819	.133	.000	.045	.057	-.010	.670	-.025	.274
Family support	-.102	.000	-.091	.000	-.136	.000	-.183	.000	-.235	.000
Self-efficacy	.215	.000	.043	.057	-.002	.940	.112	.000	.048	.033
R^2	.041		.017		.014		.032		.053	

4. Discussion and conclusions

As the LGBTQ community becomes an increasingly visible and policy-relevant social group in contemporary societies, many scholarly insights regarding gender differences are quickly becoming outdated, or, at the very least, provide an incomplete picture. Especially among today's young people, a growing number identify with a sexual or gender identity that does not align with previous categorizations. One such example is non-binary youth, who experience gender in a way that is not part of the gender binary (Clark et al., 2018) – the focus of this study. The digital development of young people is one area where these new gender identities are highly relevant to study. Youth spend a growing amount of time on digital technologies, with data indicating that LGBTQ youth spend up to 45 minutes more online on an average day than non-LGBTQ youth (GLSEN et al., 2013). Through their digital activities, these youths are exposed to a number of risks (e.g., mis- and disinformation, sexual imagery) that can cause harm (Craig & McInroy, 2014; Hatchel et al., 2021b; Lucero, 2017). Digital skills are commonly considered to be a key protective factor against such digital risks (Livingstone et al., 2021). Although various studies into digital skills and digital activities among youth have been conducted, no studies have considered differences by gender as a multidimensional construct. Our study fills this gap.

Findings indicate that the digital skill level of non-binary youth closely mirrors that of boys while being significantly higher than that of girls. This is the case for three out of five subdimensions of digital skills: technical and operational skills, programming skills, and information navigation and processing skills. As for content creation and production skills, non-binary youth reported significantly higher skills than both boys and girls. As for digital activities, non-binary youth reported using digital technologies significantly more than boys and girls for content creation and to look up information regarding mental or physical health. They also went online for entertainment purposes more frequently than girls did and used online technologies to cultivate social relationships more frequently than boys did.

The main takeaway from this study is that non-binary youth both use and feel more skilled at content creation than youth who identify within the gender binary. This is not entirely surprising. In a qualitative study on the identity development of LGBTQ youth, Craig and McInroy (2014) found that new media enabled them to access resources relevant to their identity, safely explore their identity, in part thanks to these media's anonymity, easily engage with other LGBTQ members, and (start the process) of digitally coming out. Although there are a number of risks related to this new media use as well (e.g., cyberbullying), the advantages to their identity development appear to outweigh its drawbacks. Although new media have become increasingly important to youth identity development in general (Herring & Kapidzic, 2015), they appear particularly important to LGBTQ youth. Given the key advantages that these media offer – specifically, new media that allow LGBTQ youth to create their own content and interact with other members (e.g., TikTok, Tumblr, YouTube, Instagram) –, it is then not surprising that they make more use of them (and as such, report a higher skill level) than boys and girls.

A second takeaway refers to the higher use of digital technologies for looking up health information among non-binary youth than among either boys or girls. Various studies and official statistics have shown that members of the LGBTQ community report greater psychological distress, mental health problems, and suicide ideation than non-LGBTQ members (McInroy et al., 2019a). Particularly for LGBTQ youth, who are in a key developmental phase of their lives but faced with the additional psychosocial strain of potential stigma and bullying, information of and access to necessary and relevant health services is paramount. Aside from support for mental health care, non-binary youth may also search for information regarding gender-affirming care (e.g., hormone therapy, surgery, sexual reproduction) (Clark et al., 2018). Our study clearly shows that non-binary youth use digital technologies for this purpose more frequently than those who identify within the gender binary. This highlights the need to make digital access to information about these health services widely available to LGBTQ youth. Clark et al. (2018) found that non-binary youth did not only struggle with accessing gender-affirming care, but also that information regarding this type of health care was difficult to retrieve for them. Mis- and disinformation regarding this type of care also present a significant risk for LGBTQ youth.

Although our study is the first to provide in-depth insights into the digital development of non-binary youths, we also have two key limitations. First, it is possible that there are transgender youth in our sample that have transitioned and fully identify as either boy or girl. Although they also deviate from their assigned gender at birth and thus are part of the LGBTQ community (Clark et al., 2018), we are unable to identify them with the current data. Second, the digital skills indicators that were presented were self-report measures. As such, we must be careful with interpreting these scores as 'real' digital skills, but rather as 'self-reported' digital skills. Youth's actual skill level may deviate from their own interpretation.

Taken together, this study provides a first insight into the different development of non-binary youth compared to boys and girls. It strengthens the idea that youth who do not identify within the gender binary increasingly constitute a social group that is clearly distinct from the 'traditional' gender binary in both digital skill level and the use of digital technologies. Despite some forays into the internet and social media use of LGBTQ youth for identity formation, very little information exists on the digital development of these youth. Furthermore, very few studies have incorporated different gender identities as a formal category of the investigation next to traditional gender dichotomy. We encourage future studies to increasingly consider the role of other gender identities when studying gender differences in (digital) youth development.

Notes

[1]These countries are geographically dispersed in Europe, exhibit different media ecologies, and position themselves differently on the Digital Economy and Society Index (DESI), which tracks a country's digital performance and progress in this regard.

[2]Approval for this study was obtained from the Social and Societal Ethics Committee of KU Leuven (Belgium).

Authors' Contribution

Idea, D.D.C, L.dH.; Literature review (state of the art), D.D.C, L.dH.; Methodology, L.dH.; Data analysis, D.D.C.; Results, D.D.C, L.dH.; Discussion and conclusions, D.D.C, L.dH.; Writing (original draft), D.D.C, L.dH.; Final revisions, D.D.C, L.dH.; Project design and sponsorship, L.dH.

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