



Patterns of Time Use among 12-Year-Old Children and Their Life Satisfaction: A Gender and Cross-Country Comparison

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Abstract

Despite the importance of children's time use to their quality of life, relatively few international comparative studies have focused on the patterns of children's time use and their relationship with quality of life. This study, therefore, aimed to examine the typologies of time use among 12-year-old children by gender and their relationship with their quality of life. We used the second wave of data from the International Survey of Children's Well-Being collected from 16 countries. Children's time use, gender, satisfaction with time use, and life satisfaction were included as the key variables. Latent class analysis using MPLUS 7.0 was utilized. Gender differences in the classification of time-use patterns were identified. Three latent classes (G1, G2, and G3) were identified for girls. Overall high activity group (G1) had the highest level of satisfaction, whereas family helpers (G3) had the lowest level of satisfaction with their time use and life in general. Boys, however, were classified into four classes (B1, B2, B3, and B4). Overall high activity group (B4) had the highest levels of satisfaction with their time use and life in general. The results show that children who actively engage in various activities experience the most satisfaction with their lives and time. Substantial gender differences in time use, particularly around typical gender roles (e.g., housework and family caring), are noteworthy. Programs and policies that encourage children to reduce digital time and enhance activities in other areas are also discussed.

Keywords Children · Daily activities · Time use · Latent class analysis · Gender differences · International comparative research

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1 Introduction

Time is a resource given equally to everyone. However, the way in which children use their time depends on their personal characteristics and family and social contexts. Children's time use has been of interest to researchers because it affects not only their current development and well-being but also their future prospects (Larson & Verma, 1999; McHale et al., 2001). Some consider children's use of time an economic opportunity to assist their family, whereas others considered it an investment for better future outcomes (Larson & Verma, 1999).

However, most studies on children's time use have been conducted in a single nation and the findings interpreted within their local contexts. Little is known about the commonalities and differences in children's time use patterns across countries and how they relate to their quality of life. International comparative studies have provided us with significant variations in children's time use since social and cultural contexts shape children's lives (Harkness et al., 2011). Moreover, they help us better understand how patterns of children's time use are associated with their quality of life based on these cross-cultural variations.

One of the factors found to affect variations in children's time use patterns is gender (Hilbrecht et al., 2008; Lloyd et al., 2008; Zeijl et al., 2001). However, previous studies have not fully examined how typologies of time use differ between male and female children and how these typologies that are influenced by gender-related social norms and expectations affect children's quality of life. Thus, the aim of this study is to explore time use typologies among 12-year-old children by gender and to examine how these typologies affect their quality of life. Specific attention is paid to gender differences in children's time use patterns and the differences in the distributions of these typologies across countries.

2 Literature review

The ways in which children spend time, particularly after school, can be broadly classified as work (e.g., paid work, housework, schoolwork) and leisure (Larson & Verma, 1999). Depending on how the activities are organized and who are involved, activities can also be classified as structured and unstructured (Hofferth & Sandberg, 2001). Structured activities tend to be goal-oriented (e.g., sports, music lessons, youth clubs) and are generally organized, directed, or supervised by adults (Lam & McHale, 2015). Usually, these structured activities are planned and have a regular schedule. Conversely, unstructured activities such as play are less likely to be goal-driven.

According to McHale et al. (2009), children's time spent on daily activities has been identified in previous research as 1) an investment that provides the opportunity to build the knowledge and skills necessary for the future; 2) a period of selective interactions that provide the foundation for identity development; 3) an opportunity to socialize and build affectionate relationships with others; 4) an

opportunity to develop relationships with social organizations and systems; and 5) an irreplaceable resource, implying tradeoffs between time engaging in a particular activity and losing the opportunity to engage in another. Depending on the focus, researchers have utilized one or more perceptions of children's use of time on daily activities.

However, the time that children use to engage in daily activities has been considered both the cause and consequence of child and adolescent development in the bioecological model of human development (Bronfenbrenner & Morris, 2007; Lam & McHale, 2015). The daily activities on which children spend time help them develop skills, knowledge, and behaviors, and influence their mental health and well-being. In other words, time use is a factor that affects children's development and well-being. However, children are also active agents of their own lives, soliciting opportunities and constraints regarding choices of activities in which they engage (McHale et al., 2009; Posner & Vandell, 1999). Thus, children's time use is also a consequence of their biopsychological characteristics.

According to the bioecological model of human development, the choices that a child makes are also affected by multiple levels of systems ranging from microsystems (e.g., family, peers, school, and community) to macrosystems, such as culture, economic conditions, social policy, and other environmental circumstances (Lam & McHale, 2015; McHale et al., 2009). Specifically, Gracia et al. (2020) explain that national contexts such as social norms, parenting beliefs, family values, social structures, and the labor market affect the amount of time children spend on specific activities, the types of activities that are emphasized (e.g., organized sports activities, afterschool academic institutions, free time), and the way in which these activities are provided (e.g., supervised vs. unsupervised; organized vs. unorganized; public vs. private).

2.1 Children's time use and well-being

Despite the significant influence of macrosystems on children's time use, the vast majority of studies on children's time use have been conducted in a single nation, and the findings were interpreted within their local contexts. In industrialized countries, children's use of time has been considered a resource that provides developmental and socialization opportunities and shapes their human capital (Larson & Verma, 1999; McHale et al., 2001; Sweetland, 1996). Attention has been focused on identifying specific activities (e.g., extra-curricular activity, physical activities, and academic activities) that promote positive developmental outcomes (e.g., academic adjustment, social adjustment; Wight et al., 2009) and those associated with negative outcomes (e.g., delinquency, mental health and behavior problems, risky behaviors, and obesity; Jacobs et al., 2004; Marsh & Kleitman, 2005; Shanahan & Flaherty, 2001). For example, spending time on unstructured activities with friends without adult supervision increases the risk of engaging in delinquent behaviors (Haynie & Osgood, 2005; Svensson & Oberwittler, 2010). Excessive screen time has been found to have a negative impact on children's physical and mental health (Booker et al., 2015; Mathers et al., 2009). Conversely, numerous studies have

identified the positive benefits of organized afterschool activities and family time (Fredricks & Eccles, 2006; Hofferth & Sandberg, 2001; Larson et al., 2006; Lauer et al., 2006; McHale et al., 2001; Shernoff, 2010). More recent studies have emphasized the importance of balance in the types of activities in which children engage and have warned about the negative effects of overscheduling children (Brown et al., 2011; Hertting & Kostenius, 2012).

However, studies that investigated children from developing countries have focused more on their time spent working and their tradeoff with school enrollment. Children from developing countries are more likely to be involved in work-related activities within and outside the home to economically contribute to their family (Cueto & Escobal D'Angelo, 2011; Duc & Nguyễn, 2011; Galab et al., 2011; Larson & Verma, 1999; Woldehanna et al., 2011). A seminal review article by Larson and Verma (1999) demonstrated that the differences in children's patterns of time use across countries are largely determined by the country's level of industrialization and schooling. They report that children in non-industrialized societies are expected to participate in household and paid labor at a younger age, and the amount of time spent in these activities is expected to increase as they grow older (Larson & Verma, 1999). The amount of time spent in these work-related activities is often traded off with children's time spent on schooling and other educational activities (Dornan & Woodhead, 2015; Hsin, 2007; Larson & Verma, 1999). Particularly, children from poor households in rural areas are more likely to engage in child labor (Ersado, 2004). Although little is known about how children from developing countries use their free time, there is accumulating evidence that children in developing countries also spend a significant amount of time on leisure activities (Larson & Verma, 1999; Rees, 2017; Singer et al., 2009).

Although less attention has been paid to cross-national comparisons, comparative international studies have examined how children's patterns of time use differ across countries and how they affect their academic and socioemotional outcomes (Fuligni & Stevenson, 1995; Lee, 2003; Newman et al., 2007; Won & Han, 2010). In particular, these international studies help us better understand how social and cultural contexts affect the variation in children's time use (Harkness et al., 2011; Putnick & Bornstein, 2015). Some studies have focused on examining cultural differences in time use patterns between Eastern and Western countries. These studies found that children from East Asian countries (e.g., Taiwan, South Korea, China, and Japan) are more likely to spend time engaged in academic and structured extracurricular activities (Larson & Verma, 1999; Newman et al., 2007) and to exhibit better academic achievement (Fuligni & Stevenson, 1995) than children from Western countries. However, others raised concerns that an excess amount of time spent on academic endeavors, which leaves very little time on leisure and free-time activities, may result in poor mental health outcomes (Lee, 2003).

Other studies have examined the impact of social structures on how children spend their time. For example, Gracia et al. (2020) compared the time use patterns among children from Finland, Spain, and the United Kingdom and reported that children from Spain spent more time with their families, more time at school, and in educational activities outside of school, whereas children in Finland and the United Kingdom spent more time engaging in screen-based activities. Zuzanek (2005)

compared time use among adolescents from 1980 to 2001 in ten industrialized Western countries, including Canada, Australia, Germany, the United Kingdom, and the United States, and found that there are growing commonalities in the time use patterns among countries due to globalization and advancement in technology.

The vast majority of these cross-national comparisons have been conducted between countries that have similar levels of economic development (Gracia et al., 2020; Harkness et al., 2011; Zuzanek, 2005). Some scholars question the appropriateness of comparing the lives of children living in countries with different levels of economic development (James, 2010). However, an increasing number of scholars have suggested that globalization creates greater similarities among children in economically diverse countries (Benwell, 2009; Punch, 2016; Singer et al., 2009) and that there is a need for comparative studies on the lives of children across economically diverse countries (Punch, 2016; Sauerwein & Rees, 2020). A small number of studies have examined children's time-use patterns among children from economically diverse countries and have reported inherent commonalities (Sauerwein & Rees, 2020; Singer et al., 2009). However, there are also contradictory findings (e.g., whether TV watching is more prevalent in developing or developed countries), which suggests the need for further investigation.

2.2 Gender differences in children's time use

Several studies have examined gender differences in how children spend their time, reporting that female children in both developed and developing countries spend more time doing housework than male children (Gager et al., 2009; Hilbrecht et al., 2008; Larson & Verma, 1999; Lloyd et al., 2008). Gager et al. (1999) suggest that gender differences in time spent doing housework may be due to differences in the types of housework. However, Hilbrecht et al. (2008) suggest that typical gender role expectations reflect the extent to which male and female children spend time doing housework, which is supported by gender theory.

Gender differences in how children spend their free time have also been identified. Boys are more likely to spend time playing outside, playing computer games, and participating in organized sports than girls (Newman et al., 2007; Rees, 2017; Singer et al., 2009; Zeijl et al., 2001). Hilbrecht et al. (2008) suggest that internalization of masculine gender schema in children could explain male children's preference for engaging in sports and computer/video games. However, findings regarding gender differences in children's television viewing have been mixed (Larson & Verma, 1999; Rees, 2017; Singer et al., 2009). While Larson and Verma (1999) found that boys spend more time watching television, some recent studies found no significant differences across genders (Newman et al., 2007; Rees, 2017; Singer et al., 2009). It may be possible that boys' screen time utilization has shifted from television viewing to playing computer and video games. Conversely, girls spend more time engaging in extracurricular or cultural activities (e.g., painting, musical activities, writing, reading; Rees, 2017; Singer et al., 2009; Zeijl et al., 2001). Zeijl et al. (2001) highlight that these gender differences in how children spend their free time are more pronounced during early adolescence than during later adolescence.

Although many researchers have been interested in understanding gender differences in time use among children, there are still some gaps in the literature that need to be addressed. Comparative studies have explored how male and female children differ in terms of their time use for specific types of activity; however, few studies have examined whether the typologies or patterns of time use differ by gender, as a whole, and how these differences affect children's quality of life. To address these gaps in the literature, we employed a sample of twelve-year-old children from diverse countries using international data from the Children's World survey and conducted an international comparative study to investigate 1) the typologies of time use among twelve-year-old children with a specific focus on gender differences, 2) the association between these typologies and children's quality of life, and 3) the variations in the distributions by country.

3 Methods

3.1 Data

We used the second wave data of 12-year-old children from the International Survey of Children's Well-Being (ISCWeB). The ISCWeB is an international study that aims to understand children's lives and well-being from their own perspectives (Rees & Main, 2015). The study collected data from children in three age groups: 8-, 10-, and 12-year-olds (Rees & Main, 2015). Although the initial ISCWeB report on the second wave included data from 15 countries, a further extended dataset was released at the beginning of 2018 that included 18 countries across four continents: Algeria, Colombia, Estonia, Ethiopia, Finland, Germany, Israel, Italy, Malta, Nepal, Norway, Poland, Romania, South Africa, South Korea, Spain, Turkey, and the UK. Wave 2 of the study was conducted from 2013 to 2015.

Considering that the target age groups of the survey were covered by compulsory schooling and that there were high school enrollment rates in all participating countries, a school-based sampling method was utilized (Rees & Main, 2015). This consequently places a limitation on the representativeness of the sample by excluding children out of school, who are most likely to be marginalized groups within the population.

There were some variations in the sampling and administration procedures among the participating countries. For example, in seven countries—Algeria, Colombia, South Africa, Spain, Poland, Turkey, and the UK—the sample only included part of the country, and in Germany and Nepal, specific regions were selected as part of the sampling process. Additionally, in some countries (Poland, Spain, and the UK), the questionnaires were administered online, whereas in most countries the national research team visited the school and administered the survey using a paper-based questionnaire. Therefore, caution is required when interpreting the results from countries using different data collection methods. More detailed information on the sampling and administration processes can be found in Rees and Main (2015).

The entire sample consists of 21,508 12-year-old children from 18 countries with varying levels of economic development (Table 1). As can be seen in Table 1, there is a wide variation in the number of children from each country, ranging from 852 (Germany) to 2,597 (South Korea). Thus, we utilized equal country weight, which weighs all national samples for a total of 1,000 cases to reduce the effect of different sample sizes on the analytic processes. The proportion of male participants was 49.4%. Although there were target ages for the survey, there was some variation in the actual age (in years) of the children because the survey was undertaken in school classes at varying points during the academic year. Cases remained in the final dataset if they were within two years of the target age. As a result, the mean age for each country ranged from 11.1 in Malta to 12.5 in the UK. Although it may be possible to attempt to correct for this potential age effect by using a corrected mean score, we decided not to consider the age effect because the survey was conducted for children in the same grade of the school system, which assumes an equal social age corresponding to the grade. Moreover, it would have been technically difficult to apply this approach to the agreement and frequency questions with categorical response options. This

Table 1 Number of participants and gender proportion by country

Country	Number of participants	Percentage	Gender (Male %)	GDP per capita in 2014 (USD)	Households w/ personal computer 2014, %
Algeria	1,283	6.0	57.3	5493.1	24.23
Nepal	995	4.6	50.1	844.9	7.83
Estonia	1,029	4.8	50.5	20234.1	76.00
Spain	1,667	7.8	52.8	29461.5	74.00
Colombia	975	4.5	49.9	8114.3	N/A
Turkey	1,018	4.7	45.8	12158.0	50.24
Ethiopia	980	4.6	50.1	566.9	2.11
South Korea	2,597	12.1	47.3	29249.5	82.30
Germany	852	4.0	47.5	47960.0	87.00
UK	1,319	6.1	51.2	47787.2	87.00
Israel	926	4.3	49.8	37847.6	82.08
Romania	1,507	7.0	51.4	10043.7	57.00
Norway	974	4.5	42.7	97019.2	92.00
Poland	1,017	4.7	48.9	14271.3	73.00
South Africa	1,131	5.3	45.7	6988.8	23.55
Malta	942	4.4	48.4	26754.2	78.00
Finland	1,003	4.7	48.7	50260.3	88.00
Italy	1,293	6.0	48.8	35518.4	67.00
Total	21,508	100.0	49.4		

Source: The World Bank (GDP per capita in 2014)

variation in age distribution should be considered when interpreting the results of this study.

3.2 Measurement

A major challenge in conducting an international study was to ensure that the various versions of the questionnaire in different languages were comparable. Extensive effort was made by the research group to standardize the translation process and conduct statistical testing to ensure comparability (Rees et al., 2020 for additional information). The translation process for each country was as follows: First, the standard English-language versions of the questionnaires were translated into the relevant languages and then back-translated into English independently of the original version. This back-translated English version was compared with the original English version, and discrepancies between the two versions were addressed by revising the translations.

Children's time use is one of the key sections of the questionnaires employed in ISCWEB. Children were asked questions about their time spent with family and friends and time use in general (Rees & Main, 2015). Since we were interested in *how* 12-year old children spent time, not *with whom*, the general time use questions were used for analysis. These questions explore the diverse activities children engage in when they are not at school by asking, "How often do you usually spend time doing the following activities when you are not at school?" The activities are "taking classes outside school times on matters different than at school," "participating in organized leisure time activities," "reading for fun (not homework)," "Helping around the house," "Doing homework," "Watching TV or listening to music," "Playing sports or doing exercise," "Using a computer," and "taking care of family members." Responses offered were "Rarely or never (0)," "Less than once a week (1)," "Once or twice a week (2)," and "Every day or almost every day (3)."

Satisfaction with time use is a 1-item question that asks, "How satisfied are you with what you do in your free time?" Children responded to this question using an 11-point scale ranging from "0=not at all satisfied" to "10=totally satisfied." The satisfaction with time use item was treated as a continuous variable in the analysis, based on the argument that Likert or ordinal variables with five or more categories could be treated as continuous without any harm to the analysis (Johnson & Creech, 1983; Norman, 2010; Sullivan & Artino, 2013; Zumbo & Zimmerman, 1993).

The Student Life Satisfaction Scale (SLSS) consists of five sentences about how children feel about their life as a whole. Four items ("My life is going well," "My life is just right," "I have a good life," and "I have what I want in life") were derived from the SLSS (Huebner, 1991) and one item ("The things in my life are excellent") were adapted from Satisfaction with Life Scale (Diener et al., 1985). For each item, response options ranged from 0 (totally disagree) to 10 (totally agree). The total score was transformed to 100-point scale by multiplying the original score by 10. Although the SLSS is an ordinal scale, the values were treated as continuous, based on the strong argument that while Likert questions or items may well be ordinal, Likert scales, consisting of sums across multiple items, will be interval (Norman,

2010). Cronbach's alpha of this scale for each country ranged from 0.682 in Nepal to 0.966 in South Korea. Cronbach's alpha was above 0.8 in all countries except Nepal, resulting in a total Cronbach's alpha of 0.919.

3.3 Data analysis

A descriptive analysis of each item of children's time use and Mann–Whitney U tests for gender differences were conducted as preliminary analyses. Since children's time use was measured with a 4-point ordinal scale, nonparametric tests were used to analyze gender differences. Based on the results of Mann–Whitney U test, we assumed that different patterns of time use exist between boys and girls. To identify the typologies of children's time use in each group, we employed latent class analysis (LCA) for girls and boys. Person-centered approaches such as LCA have the advantage of providing categorical groupings of respondents based on observed responses (Lovegrove & Cornell, 2014). Hunt and McKay (2015) specifically underscored the importance of a person-centered approach when examining children's time use and its association with their quality of life. The number of classes is determined through comparisons of fit statistics, while relevant theory and substantive interpretation of classes are ultimately considered (Hooper et al., 2015). We utilized multiple model fit indices owing to the complexity in determining the proper number of classes: the Akaike information criteria (AIC), Bayesian information criteria (BIC), sample-size adjusted BIC (SABIC), Lo-Mendell-Rubin Likelihood Ratio Test (LMR-LRT), the Vuong-Lo-Mendell-Rubin Likelihood Ratio Test (VLMR-LRT), and entropy. AIC, BIC, and SABIC are information criteria that are used to indicate the relative fit of each model with a different number of classes (Hooper et al., 2015). A lower value for each information criterion indicated a better model fit. However, likelihood ratio tests (LRT) allow us to statistically compare the model fit between a model with k number of classes and $k-1$ (Asparouhov & Muthén, 2012; Nylund et al., 2007). A significant p -value indicates that the model with k classes is a better fitting model than a model with $k-1$ classes (Nylund et al., 2007). Additionally, while entropy is not a criterion for determining the class number, it is used as a measure of classification certainty (Hooper et al., 2015). Entropy values closer to 1 indicate better classification (Hooper et al., 2015).

After identifying the adequate number of groups (i.e., "latent classes"), a three-step approach was used to investigate differences in satisfaction with time use and life among the groups based on respondents' most likely class membership, while accounting for the classification uncertainty rate. A three-step method has been developed to independently evaluate the relationship between a latent categorical variable and predictor or distal auxiliary observed variables while avoiding several disadvantages of the one-step method (Asparouhov & Muthén, 2014). A significant disadvantage of the one-step approach is that once auxiliary variables (e.g., covariates or distal outcomes) are included in a mixture model, the measurement parameters of the latent class model could shift, implying that the item probabilities used to assign names to the latent classes could change when comparing a model with and without covariates (Nylund-Gibson et al., 2014). In a

three-step approach, the unconditional mixture model is estimated using only the latent class indicators (step 1), and for each individual, the most likely class variable is assigned (step 2). In the third step, the effects of auxiliary variables are estimated using the most likely class variable as a latent class indicator variable, with measurement error in the most likely class variable being taken into account (Asparouhov & Muthén, 2014). IBM SPSS Statistics version 20.0 was used for preliminary analyses; Mplus version 7.2 was used for LCA and a subsequent analysis with the three-step approach.

Missing data were checked, and the missing rate for each item ranged from 0.7% to 9.7%. In **Latent Class Analysis**, the model is estimated by ML, which does not need to use imputation of missing values but directly computes the parameter estimates using all available information, taking the missingness into account under the assumption of MAR (missing at random). Therefore, the missing rate for the final model (LCA with 3-step approach) was reduced to 4.6% for the boy group and 4.5% for the girl group with no missing data in the latent class group, which was estimated from LCA. A total of 1.5% (32 cases) of the sample did not provide information on gender and were therefore not included in the analysis.

Table 2 How children spend their time after school

	Group	N	Mean Rank	Sum of Ranks	U
Taking classes outside school time	Boy	8219	8507.91	69,926,489.50	33,074,018.50***
	Girl	8422	8138.60	68,543,271.50	
Participate in organized leisure time activities	Boy	8061	8344.15	67,262,181.50	31,194,872.50***
	Girl	8183	7904.16	64,679,708.50	
Reading for fun	Boy	8589	8275.01	71,074,069.00	34,184,314.00***
	Girl	9053	9339.98	84,554,834.00	
Helping with housework	Boy	8662	8500.05	73,627,435.00	36,107,982.00***
	Girl	9156	9296.86	85,122,036.00	
Doing homework	Boy	8687	8576.30	74,502,289.00	36,765,961.00***
	Girl	9162	9255.62	84,800,036.00	
Watching TV	Boy	8524	8666.43	73,872,614.50	37,539,064.50**
	Girl	9017	8869.86	79,979,496.50	
Playing sports or doing exercise	Boy	8706	9656.33	84,068,020.50	33,275,800.50***
	Girl	9125	8209.66	74,913,175.50	
Using a computer	Boy	8478	9088.00	77,048,104.00	34,780,955.00***
	Girl	8951	8361.71	74,845,631.00	
Taking care of family members	Boy	8490	8765.04	74,415,218.00	37,096,687.00*
	Girl	8889	8618.33	76,608,292.00	

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

Table 3 Model fit indices for class solutions: Girls

	Class 1	Class 2	Class 3
AIC	208,942.337	204,915.220	203,404.158
BIC	209,139.204	205,316.245	204,009.341
Sample adjusted BIC	209,053.401	205,141.462	203,745.578
VLMR-LRT		p = 0.0000	p = 0.0000
LMR-LRT		p = 0.0000	p = 0.0000
Entropy		0.619	0.605

4 Results

4.1 Preliminary analyses

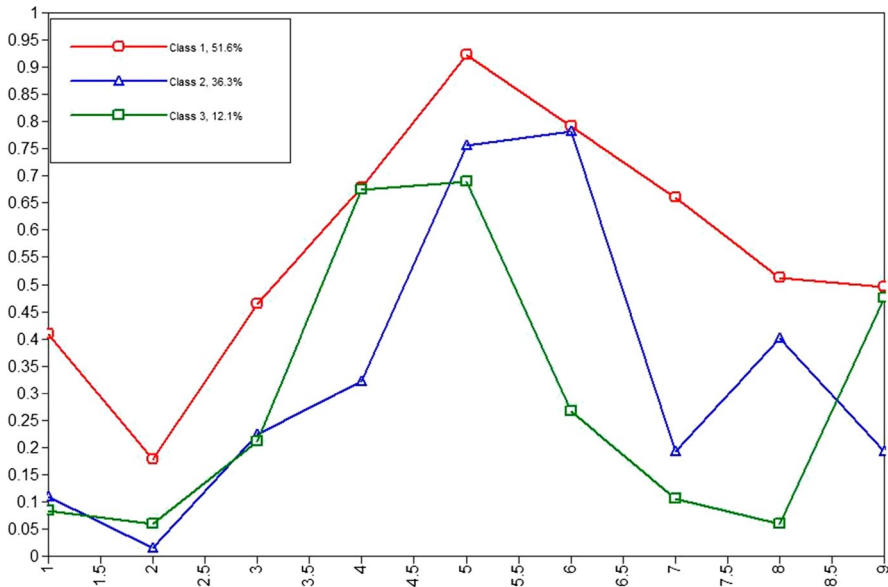
Ten indicator variables were used to identify the time-use patterns of 12-year-old children. These variables consist of activities children usually perform after school. The frequency of each activity reflects how they spend their time after school. Descriptive statistics and the results of the Mann–Whitney U test of the indicator variables are presented in Table 2. Descriptive statistics show that the activities children most frequently engage in are doing homework and watching TV for both genders. However, there were significant differences in the time use pattern by gender. As shown in Table 2, the third activity that boys most frequently engage in is “playing sports or doing exercise,” whereas it is “helping with housework” for girls. Boys tend to take more after school classes and participate in organized leisure time activities, while girls more often read books and help with housework. In addition, girls more often do homework, while boys more often play sports and use computers. The activities that showed relatively similar mean ranks were “watching TV” and “taking care of family members,” although both activities were also found to be significantly different by gender.

4.2 Latent class analysis

4.2.1 Girls' time use pattern

The model fit indices show that a three-class model fits best for girls (Table 3). Additional analysis cannot be conducted because estimation errors occur when running a four-class model. The information criteria decreased continuously as the number of classes increased, and a test of statistical significance of both LRTs (VLMR-LRT and LMR-LRT) suggests that the model fit with three classes has significantly improved when compared with the two-class model.

The proportions of girls in each group were 51.6%, 36.3%, and 12.1%, respectively. The time-use patterns for each group are presented in Fig. 1. The first group, with the largest portion (51.6%), showed a high level in all suggested activities and was named the “overall high activity group.” The second largest group (36.3%) showed a relatively high frequency of TV watching and relatively low levels of engagement in other activities. Thus, the second group was labeled “TV watchers.”



Note. Taking Classes (1), Organized Leisure (2), Reading for Fun (3), Helping with Housework (4), Doing Homework (5), Watching TV (6), Engaging in Sports/Exercise (7), Using a Computer (8), Caring for Family Members (9)

Fig. 1 Latent Class Analysis: Class Membership of Girls. Note. Taking Classes (1), Organized Leisure (2), Reading for Fun (3), Helping with Housework (4), Doing Homework (5), Watching TV (6), Engaging in Sports/Exercise (7), Using a Computer (8), Caring for Family Members (9)

The last group consisted of only 12.1% of the sample and was characterized by high levels of housework and family caring activities and low levels of activities in others. Thus, the last group was labeled “family helpers.”

4.2.2 Boys’ time use pattern around the world

For boys, the four-class model was found to fit the best (Table 4). An estimation error occurred when we attempted to fit a six-class model. Among the five models,

Table 4 Model fit indices for class solutions: Boys

	Class 1	Class 2	Class 3	Class 4	Class 5
AIC	207,269.019	203,605.477	201,972.207	200,591.074	199,869.074
BIC	207,465.154	204,005.011	202,575.140	201,397.407	200,878.806
Sample adjusted BIC	207,379.351	203,830.229	202,311.378	201,044.664	200,437.083
VLMR-LRT		p=0.0000	p=0.0005	p=0.0002	p=0.0040
LMR-LRT		p=0.0000	p=0.0006	p=0.0002	p=0.0041
Entropy		0.540	0.578	0.594	0.588

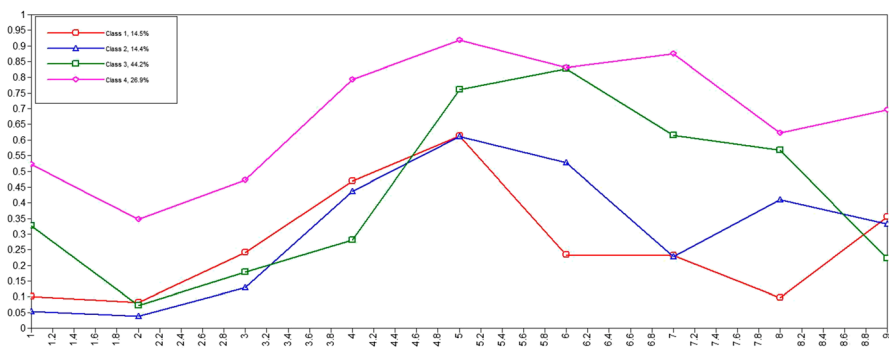
we decided that a four-class model is the best fitting model for boys, even though the model fit indices indicate that a five-class model has a better model fit. The reason for this decision is based on the interpretability of the identified classes. Although a five-class model has similar patterns with a four-class, the proportion of the last group was very small (8.3%) and difficult to interpret. In addition, the entropy value indicates a better classification for the four-class model than for the five-class model.

When we examine the group membership of boys, their time use patterns tend to be divided depending on their screen time, which means the frequency of watching TV and using the computer (Fig. 2). Group 1, which was labeled as the “medium activity group with lower screen time,” included 14.5% of the sample. Group 2, labeled as “lower activity group with high screen time,” included a similar portion of 12-year-old boys (14.4%). Group 3, which included the largest portion of boys (44.2%), was labeled as the “high screen time, homework, and sports exercise group” and was characterized by high TV watching, computer use, homework, and sports exercise. Group 4, the overall high activity group, included about 27% of the boys.

4.3 Group membership by country

4.3.1 Girls' group membership by country

After identifying the time-use patterns of girls around the world, we analyzed the constitution of each group by country. Finland, Malta, and Estonia had the largest proportion of children in the “overall high activity group,” while South Korea and



Note. Taking Classes (1), Organized Leisure (2), Reading for Fun (3), Helping with Housework (4), Doing Homework (5), Watching TV (6), Engaging in Sports/Exercise (7), Using a Computer, (8) Caring for Family Members (9)

Fig. 2 Latent Class Analysis: Class Membership of Boys. Note. Taking Classes (1), Organized Leisure (2), Reading for Fun (3), Helping with Housework (4), Doing Homework (5), Watching TV (6), Engaging in Sports/Exercise (7), Using a Computer (8), Caring for Family Members (9)

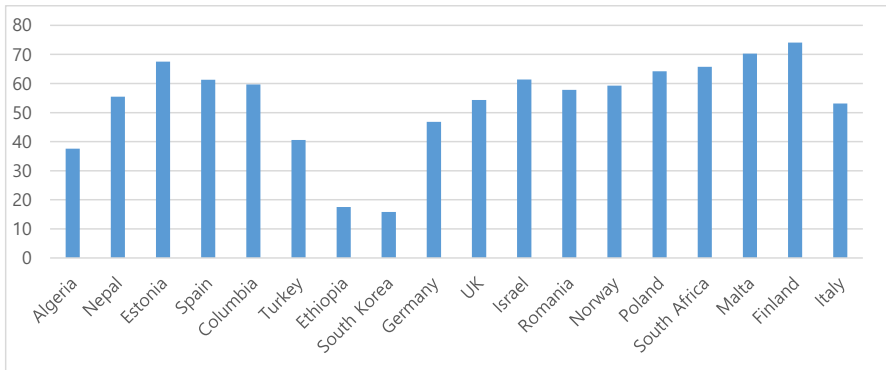


Fig. 3 Percentage of Group 1 Girls in 18 Countries of ISCWeB (2nd wave)

Ethiopian children had the smallest proportions when compared with other countries (Fig. 3).

South Korean children had the largest proportion of children in the second group. More than 70% of Korean children were TV watchers, while only 10% of Ethiopian and Nepalese children belonged to this group (Fig. 4).

Three countries stood out in the third group. More than 70% of Ethiopian girls were family helpers, and about 30% of Algerian and Nepalese girls belonged to this group (Fig. 5). When compared to the proportion of Ethiopian and Nepalese girls in the second group (TV watchers), this finding suggests that Ethiopian and Nepalese girls may not watch TV often because of their heavy engagement in family work.

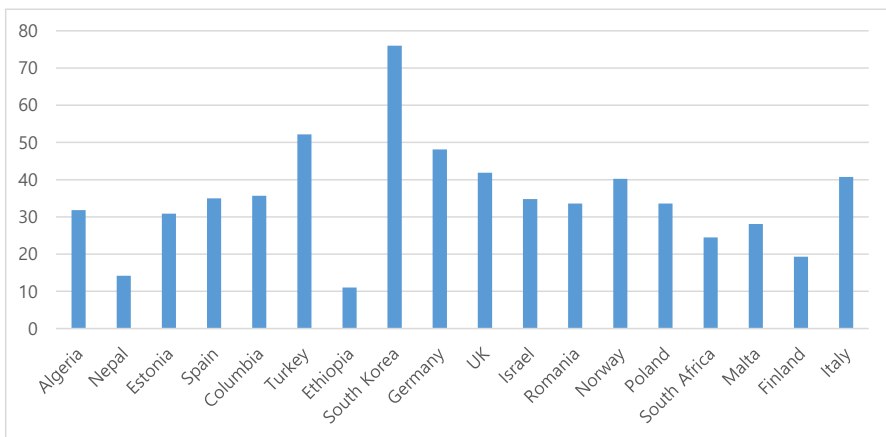


Fig. 4 Percentage of Group 2 Girls in 18 Countries of ISCWeB (2nd wave)

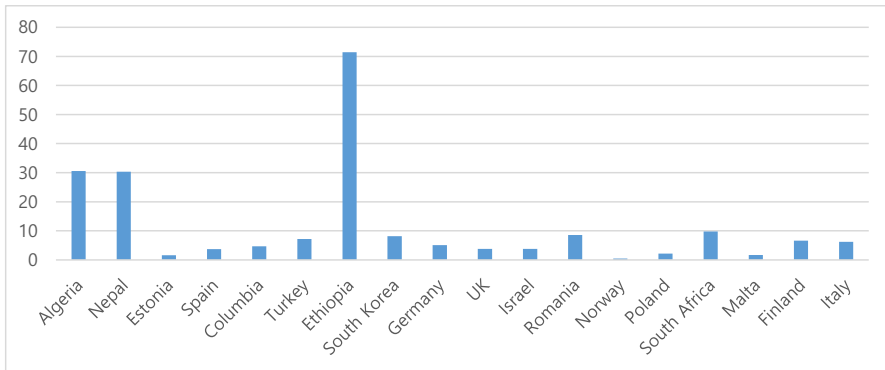


Fig. 5 Percentage of Group 3 Girls in 18 Countries of ISCWeB (2nd wave)

4.3.2 Boys' group membership by country

The proportion of memberships for boys in each group was analyzed by country. Almost half of the Ethiopian and Nepalese boys belong to Group 1 (Fig. 6). This may be due to their limited access to the media when compared to other countries.

In the second group, Ethiopian boys again constituted the largest proportion. Although this is the lower activity group with high screen time, it was the second lowest group in the frequency of screen time use among boys (Fig. 7). Therefore, Ethiopian boys may have taken the largest part again. The name of the second group was designed to contrast group 1.

In the third group, high screen time, homework, and sports exercise groups, Germany, Poland, and Italy had the largest proportions while developing countries such as Algeria, Nepal, and Ethiopia were ranked in the bottom three (Fig. 8). In particular, less than 10% of the Ethiopian boys belonged to this group.

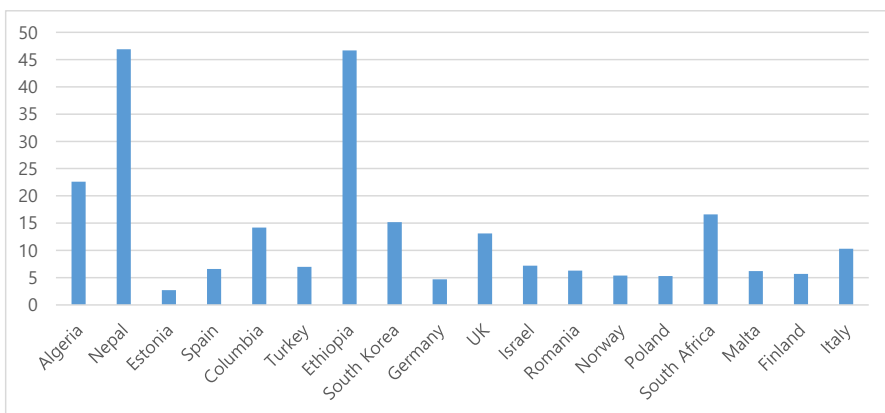


Fig. 6 Percentage of Group 1 Boys in 18 Countries of ISCWeB (2nd wave)

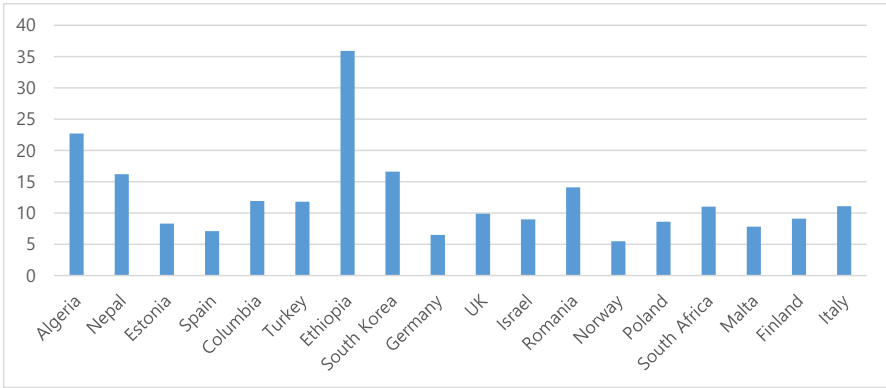


Fig. 7 Percentage of Group 2 Boys in 18 Countries of ISCWeB (2nd wave)

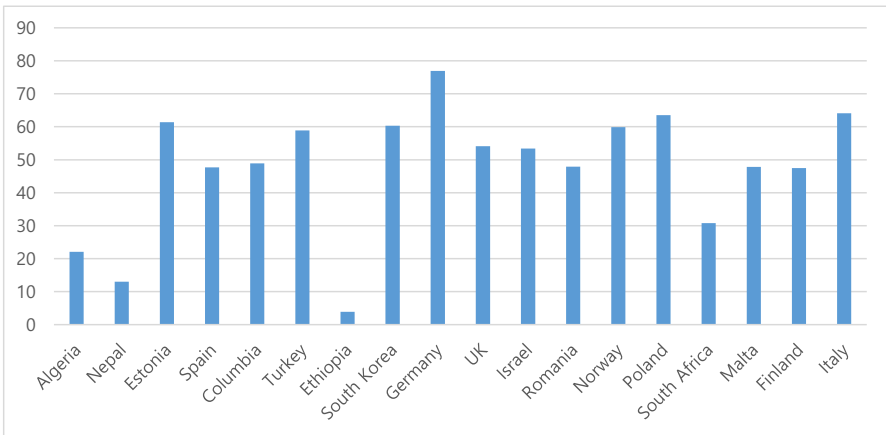


Fig. 8 Percentage of Group 3 Boys in 18 Countries of ISCWeB (2nd wave)

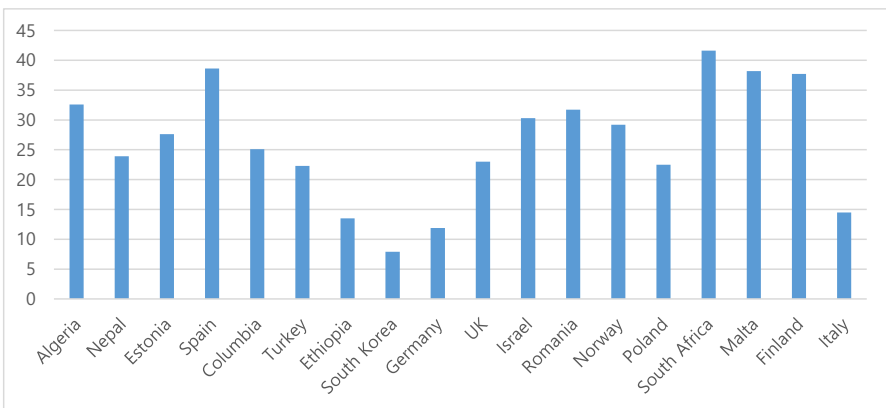


Fig. 9 Percentage of Group 4 Boys in 18 Countries of ISCWeB (2nd wave)

In the overall high activity group, children from South Africa, Spain, Malta, and Finland had the largest proportions, while less than 10% of South Korean children belonged to this group (Fig. 9).

4.4 Analysis with the 3-step approach for distal outcomes

The 3-step approach was employed to model a distal outcome predicted by a latent categorical variable. Two distal outcomes (satisfaction with time use and life satisfaction) were examined to compare the quality of life among the groups.

4.4.1 Comparison of satisfaction with life and time use: Girls

Satisfaction with life and time use among the latent classes was explored for girls. The mean of each group was calculated. Then, a significance test for differences was conducted using the 3-step approach (Table 5). Each pair of groups was compared to test the significant differences between groups, and the results of the Wald test of parameter constraints showed that the means of all three groups were significantly different from each other ($p < 0.001$).

For girls, group 1 (overall high activity group) had the highest level of satisfaction with life and time use, while group 3 (family helpers) had the lowest level of satisfaction at the level of statistical significance. Group 2 (TV watchers) ranked in the middle, yet their scores were much closer to those of Group 1. Noticeably, the satisfaction scores of group 3 were less than half of the other two groups, suggesting that there is a major disparity between group 3 (family helpers) and the other two groups.

Table 5 Differences in satisfaction with life and time use among groups: Girls

	Group 1	Group 2	Group 3	Rank
SLSS5	91.226(0.231)	85.620(0.434)	39.471(1.044)	1 > 2 > 3
Satisfaction with Time Use	9.020(0.027)	8.199(0.053)	3.331(0.151)	1 > 2 > 3

4.4.2 Comparison of satisfaction with life and time use: Boys

The results of the significance test for differences in male groups also show that each pair of groups is significantly different from the other (Table 6). For boys, group 4 (overall high activity group) had the highest level of satisfaction with life and time use,

Table 6 Differences in satisfaction with life and time use among groups: Boys

	Group 1	Group 2	Group 3	Group 4	Rank
SLSS5	84.169 (0.810)	43.950(1.196)	89.526 (0.286)	93.309 (0.224)	4 > 3 > 1 > 2
Satisfaction with Time Use	8.395(0.096)	3.799(0.185)	8.716(0.034)	9.274 (0.028)	4 > 3 > 1 > 2

whereas group 2 (lower activity group with high screen time) had the lowest level of satisfaction. Group 3 (high screen time, homework, and sports exercise group) and group 1 (medium activity group with lower screen time) were in the middle group, although group 3 had a slightly higher level of satisfaction with life and time use. Again, significant differences were found between Group 2 and the other three groups of boys.

5 Discussion

This study sought to identify the typologies of time use among children in 18 countries using latent class analysis. The findings suggest that the typologies of time use among 12-year-olds differ by gender, which supports previous findings of significant gender variations in children's time use (Newman et al., 2007; Rees, 2017; Singer et al., 2009; Zeijl et al., 2001). A three-class model, which included group 1 (overall high activity group), group 2 (TV watchers), and group 3 (family helpers), was found to fit the best for girls. The typologies of time use among girls were mostly distinguished by the distinctive activities in which they were engaged. Conversely, a four-class model, which included group 1 (medium activity group with lower screen time), group 2 (lower activity group with high screen time), group 3 (medium activity group with higher screen time), and group 4 (overall high activity group), was found to fit best for boys. The classification around screen time suggests its importance in the life of 12-year-old boys across various countries (Singer et al., 2009).

The different classifications that were identified are supported by previous literature highlighting the importance of doing housework among girls (Bonke, 2010; Gager et al., 2009; Hilbrecht et al., 2008; Larson & Verma, 1999). However, the importance of screen time in classifying time use patterns among boys is also supported by previous studies that identified engagement in watching TV and using the computer as important activities for determining the patterns of time use among boys (Newman et al., 2007; Rees, 2017; Singer et al., 2009; Zeijl et al., 2001), which suggests that children at this age follow a gender schema or gender-based social norms and spend their time following gender-based expectations.

In addition, the analysis of group constitution by country resulted in different patterns of class membership regarding time use among 18 countries. This finding confirms that social and cultural contexts also shape children's lives. Specifically, in most European countries, the proportion of girls in group 1 (overall high activity group) was the highest, whereas the percentage of girls who belonged to group 3 (family helpers) was the lowest. However, the proportion of girls classified as group 3 (family helpers) was the highest in Ethiopia (over 70%) and relatively high in Nepal and Algeria. These three countries had the lowest GDP per capita among the 18 countries. South Korean girls show a peculiar pattern of time use. The highest proportion of girls were classified as group 2 (TV watchers), while a very low proportion of girls were identified in both group 1 (overall high activity group) and group 3 (family helpers). This finding suggests the lack of opportunity for 12-year-old South Korean girls to engage in diverse activities.

Different patterns of class membership were also found in boys. Ethiopia, Nepal, and Algeria had the highest proportion of children in Group 1 (medium activity group with lower screen time). Ethiopia and Algeria also had the highest scores in Group 2 (lower activity group with high screen time). For most countries included in the sample, group 3 (medium activity group with higher screen time) had the highest proportions, with the exception of Ethiopia, Algeria, Nepal, and South Africa. In group 4 (overall high activity group), boys from South Korea, Ethiopia, Germany, and Italy comprised less than 15%, while more than 40% of South African boys belonged to this group. About 40% of the boys from Spain, Malta, and Finland also belonged to this group.

When we examined the associations between time use patterns and children's quality of life, we found that children's satisfaction with life and time use differed by their group membership. This is consistent with previous results that suggest that children's satisfaction with time use is significantly related to their overall happiness (Ahn, 2018). We also found that the economic and cultural context of the country inevitably affects children's time use patterns and quality of life and found evidence of disparity among children living in low-income countries. Children from countries with the lowest economic level were found to have the highest proportion of group memberships in groups with the lowest satisfaction level, regardless of their gender.

In terms of the associations between group classification and children's well-being, we found that those who were classified to be in the overall high activity group had the highest level of satisfaction with the overall quality of life and time use for both boys and girls. These findings further support existing studies that emphasize the positive effects of the breadth of children's activities on their outcomes (Denault & Poulin, 2009; Fredricks & Eccles, 2010; Larson et al., 2006; Sharp et al., 2015). Specifically, we found similar results to those of Sharp et al. (2015), who also used a person-centered approach to identify activity patterns and demonstrated the positive effects of consistently engaging in a wide range of organized and unstructured activities on adolescents. It is hypothesized that engagement in a diverse range of activities helps children not only develop their identity and self-interest but also experience a wider range of growth and social networks, and may help them better handle stressful situations (Bohnert et al., 2010).

Conversely, girls who were classified as "family helpers" showed the lowest level of satisfaction with life and time use. In particular, girls from developing countries were more likely to be found in this group. This is consistent with previous studies that have identified the heavy load of housework imposed on these girls (Bruckauf & Rees, 2017; Larson & Verma, 1999; Lloyd et al., 2008). When girls are overly engaged in housework, they are prevented not only from engaging in other types of activities but also from opportunities for peer socialization, since such housework is mostly led by same-sex adults (Lloyd et al., 2008). There is also the possibility that girls' heavy housework is a strategy for low-income families to manage their daily lives (Dodson & Dickert, 2004), and low life satisfaction could be a function of limitation in both time and monetary resources.

For boys, heavy screen time seems to be a major determinant of their time use patterns and, consequently, a major determinant of their life satisfaction. Despite the

growing amount of time devoted to computer games and mass media, the low satisfaction with time use and life among those whose main daily activities are watching TV and using a computer supports the growing evidence of the negative association between screentime and quality of life (Garcia-Hermoso et al., 2020; Stiglic & Viner, 2019). Specifically, this finding is consistent with a systematic review by Stiglic and Viner (2019), who identified a moderate level of evidence for a negative association between screen time and quality of life. However, the low level of participation in other types of activities, except for screen time, may be due to lack of time or resources to supervise or provide other activity options or due to concerns for children's safety in other types of activities (Singer et al., 2009).

In this study, we were only able to measure the frequency of each activity and were not able to measure the amount of free time that children had during the week. Thus, the "overall high activity group" may represent children with more free time, which may allow children to choose how they want to spend their time from a wide variety of options. Both the quantity and quality of children's free time should be considered when trying to address their time use and quality of life. Ensuring more free time and helping them allocate their time to more balanced and diverse activities seems to be critical when trying to enhance children's quality of life. Adults and society, in general, should be more aware of the link between children's time use and their well-being. Until recently, society has mostly focused on developing children into successful adults and good citizens. However, while providing them with guidance to engage in a wide range of activities, child-led decisions on how they should spend their time may help children understand the link between their time use and level of satisfaction, especially life satisfaction.

We sought to examine how children's time use patterns differed by gender and how these patterns were associated with children's life and time use satisfaction. Our research contributes to the growing literature on gender differences in children's time use by showing that not only do time use patterns differ between boys and girls, but they also show different types of activity (e.g., girls: housework and caring for family members, boys: watching TV and using a computer) that determine the patterns of time use by gender. This study can provide background information for future studies that seek to investigate the differential effects of children's daily activities on their quality of life. In particular, recent restrictions in children's activities due to COVID-19 may have affected boys and girls differently, and this study provides an empirical basis for investigating these differential effects.

These findings highlight the importance of children's engagement in a wide range of activities and their positive effects on children's quality of life, providing empirical support for diverse opportunities for children to engage in various activities. First, the risk factors associated with deprivation in a variety of daily activities may need to be assessed. For example, neighborhood safety may restrict children from engaging in outdoor activities such as leisure, sports, and exercise, and inadvertently promotes excessive screen time. If this is the case, community efforts to secure safe environments and adult supervision to actively promote structured and unstructured, age-appropriate activities are necessary. Second, schools and community organizations must provide opportunities for children to explore various structures and unstructured activities. Schools and other community organizations can encourage

children to engage in new activities to open their horizons and promote online and offline exhibitions, concerts, talent shows, book concerts, and other events to motivate children to participate in various activities and acknowledge their accomplishments. Third, although children's socioeconomic status (SES) was not considered in our study, children with low SES were at a greater risk of limited activities (Tandon et al., 2012). Thus, policies that provide economic support (e.g., vouchers and equipment) to enhance children's participation in various activities may help children with low SES expand their interest and participate in a wide range of activities.

Adults should be cognizant of the message that they send to their children regarding gender norms and expectations. Their guidance should not be gender-based and not impose adults' views ("what children should do"), but rather reflect children's views ("what they want to do") to enhance their well-being. While there could be cultural differences, education on gender equality, children's right to participate in the decision-making process regarding their life, and children's right to participate in their choice of activities during their free time need to be provided to both children and their parents.

There are several limitations to this study that need to be addressed. First, the study utilized a sample of 12-year-olds from the ISCWeB, which is a school-based survey. As a result, children who were not enrolled in schools or who did not attend school for various reasons were not able to participate in the study. Particularly, children from developing countries who often trade off their time at school with time at work may not have been able to participate in this study. In addition, we did not correct the age variations that countries have in the 12-year-old sample, which may contribute to different patterns of time use in some countries, along with the variations in sampling strategy and administration procedure applied in each country. We assessed children's time use by asking how often they spend time in particular activities during the week. However, we did not measure the actual number of hours children spend on these activities using time diaries or other sophisticated methods for measuring time use. Thus, future studies that assess children's time use patterns using more sophisticated measures of time are needed to better understand children's time use patterns.

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Data availability The data used in this study were the twelve-year-old sample from the second wave of Children's Worlds: International Survey of Children's Well-Being (ISCWeB). The data are available from <https://isciweb.org/> by request.

Declarations

Disclosure of potential conflicts of interest The authors declare that they have no conflict of interest.

Research involving Human Participants This research utilized secondary data from the second wave of Children's World project: An international survey of children's lives and well-being (www.isciweb.org).

The research procedure followed for this manuscript were in accordance with ethical standards of Seoul National University Institutional Review Board. Ethical approval for each country's data collection is received by each respective research team within each country (Please see Rees & Main, 2015 for detailed information).

Informed consent Since we utilized secondary data from the Children's World project, additional informed consent was not necessary. However, Children's World project indicates that informed consent were collected from all the children who participated in the data collection. In addition, depending on the respective country's standards for research ethics, active or passive consent from parents or schools were obtained (Rees & Main, 2015).

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