



Well-being in late childhood and early adolescence: evolution and explanatory factors

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Abstract

This paper has three objectives (1) to test whether a decrease in well-being scores is observed from one year to the next in the period between 10 and 16 years of age when measured using indicators of subjective well-being (SWB) (including the OLS as a global measure) and psychological well-being (PWB); (2) to explore the contribution of the primary/secondary school, gender and age in explaining global SWB; and (3) to identify potential non-linear relationships between SWB, measured globally, and other indicators of SWB and PWB. To this end, data were analysed from 994 Spanish students, who responded to the same self-administered questionnaire over two consecutive school years and were recruited through a process of non-random sampling. The results obtained using Student's t-test for repeated measures and generalized additive models (GAM) showed a statistically significant decrease in 10 out of the 20 indicators considered (more of which assess PWB than SWB), and that the indicators measuring the SWB affective component made a more relevant and less linear contribution to a global SWB measure than those measuring the cognitive component or the PWB.

Keywords Subjective well-being · Psychological well-being · Childhood · Adolescence · Longitudinal · GAM models

Introduction

Subjective well-being (SWB) is one of the central concepts of the quality-of-life paradigm and is based on a positive approach to the study of human behaviour, health, and its determinants. SWB has been conceptualized as the way in which people evaluate their lives, regardless of age, both in general and in relation to specific life domains (family, friends, leisure time, etc.) (Campbell et al., 1976), the notion of “satisfaction” being a key concept for investigating the cognitive structure of SWB. However, when studies in this area first began in the 1960s, SWB was already considered to comprise not only a cognitive component (life satisfaction), but also an affective component with two dimensions (positive and negative affect), reflecting the so-called

tripartite structure theory of SWB (Arthaud et al., 2005; Diener, 1984; Metler & Busseri, 2017) that has been taken as a reference for many years. Both the cognitive and affective dimensions are included in this study, in line with current research.

Although research on children and adolescents still has a long way to go at the population level compared to that conducted with adults, there is a growing awareness of the need for indicators based on the SWB of young people to help decision-making in the context of public policies (see the discussion in this regard in Casas, 2011). The interest in monitoring progress using these indicators has also grown (Marquez & Long, 2021). Recently, the adoption of Bronfenbrenner's ecological approach (Bronfenbrenner, 1981; Bronfenbrenner & Evans, 2000; Bronfenbrenner & Morris, 1998) has placed great emphasis on young people's SWB in relation to the intersection of the different contexts in which they are immersed, mainly family, neighbourhood and school (González-Carrasco et al., 2019; Oyarzún et al., 2019; Sarriera, 2010).

In recent years, a decreasing-with-age trend has been identified in SWB levels between the ages of 10 and 16 (Casas & González-Carrasco, 2020a, b; González-Carrasco et al., 2017a, b), depending on the country, which usually

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coincides with important life transitions (e.g., the transition from primary to secondary education). Mainly observed when comparing different ages in cross-sectional studies, this phenomenon has barely been contrasted in longitudinal studies, greatly limiting our knowledge of the factors leading to this decline and, therefore, to developing prevention actions based on empirical evidence.

The question of whether changes in SWB occur during late childhood and early adolescence has only lately received attention from researchers working in the field, despite this being a period in which well-being appears to have its own particularities with respect to earlier and later age groups (Cummins, 2000). Models (e.g. Diener's 1999 SWB trajectory model, Durayappah's, 2011 3P model and Carstensen et al.'s, 1998 socioemotional selectivity theory, SST, that include evolution over time as a relevant variable when theorizing about SWB do so in such a generic way that it is difficult to make predictions about the variations that may occur throughout life. In addition, most models are unable to explain the changes in SWB scores that may take place during any given period.

As an exception to this, although still formulated with the adult population in mind, we find the homeostatic model (Cummins, 2000), which uses the body's biological systems in control of functions like blood pressure and heart rate as an analogy to explain variations in SWB. Following this example, there are minimum and maximum values for regulating the two aforementioned processes, and these define an expected range of normative levels. Although numerous external and internal factors can alter an individual's levels (e.g., stress and illness), under normal circumstances they tend to return to baseline values after deviating from them.

Similarly, a genetic mechanism is considered to control SWB homeostatically, which would explain the existence of relatively small variations in SWB levels among people of the same culture, except in those cases in which protective factors have failed. There can be no doubting the interest of this model in explaining variations in SWB levels. However, despite the expected levels in the basic biological functions mentioned varying with age (blood pressure tends to increase, while heart rate tends to decrease), the model has not yet incorporated evolution over time in a way that helps explain the changes that occur in the SWB of children and adolescents, which is anything but static and generally displays higher scores compared to adults in the same context.

In addition to the above, as mentioned earlier, most studies on the SWB of young people are cross-sectional in nature, which poses an obstacle to knowing in any depth how the evolutionary changes that occur throughout their development affect or are affected by their SWB. A few years ago, several cross-sectional studies began to reveal

that the supposed stability thought to also characterize SWB during this life stage may not actually be occurring (Chui & Wong, 2016; Currie et al., 2012; Goldbeck et al., 2007; Liu et al., 2016; Singh et al., 2015). Two main results were observed. On the one hand, a decreasing-with-age-trend, according to which SWB levels decrease between the ages of 10 and 16 (Casas & González-Carrasco, 2020a, b; González-Carrasco et al., 2017a, b; Herker et al., 2019; Katsantonis et al., 2022; Tiliouine et al., 2019; Uusitalo-Malmivaara, 2014). And on the other hand, that the pattern of decline is more pronounced among girls than boys, the former obtaining lower levels than the latter despite starting from higher scores (González-Carrasco et al., 2017a; Herke et al., 2019; Uusitalo-Malmivaara, 2014). This justifies the interest in considering both age and gender in studies of this kind.

Knowing when the aforementioned decline occurs and what may cause it will allow for the introduction of actions aimed at its prevention, especially in those cases in which it may be particularly pronounced and external environmental factors may play a very important role. Another relevant observation is that longitudinal studies have often used only single-item measures of life satisfaction (Lucas & Donnellan, cited in Salmera-Aro & Tuominen-Soini, 2010), despite the fact that multi-item SWB scales (González-Carrasco et al., 2017a, b) are more robust.

Many authors have explained overall life satisfaction (OLS), taken as a global measure of SWB, as the linear combination of satisfaction with different specific domains (e.g., satisfaction with oneself or with the people one lives with) (see Diener, 1984, for a more detailed description), assuming that all dimensions have more or less the same influence and that they behave in the same way in relation to the more general construct, which is difficult to sustain from a conceptual point of view (see Sirgy, 2021, for an alternative vision in terms of *bottom-up spillover*). Previous studies have shown (see González et al., 2010, 2008, 2007) that adopting a non-linear approach from a bottom-up perspective contributes to increasing our understanding of this relationship and that it is necessary to continue moving research forward in this regard. The extension of these non-linear analyses to positive and negative affect is yet to be addressed, however, a gap that this work attempts to fill.

Children's and adolescents' subjective well-being and psychological well-being

The notion of SWB has traditionally been differentiated from that of psychological well-being (PWB), to such an extent that researchers have tended to focus on one to the detriment of the other, even though a growing number of researchers argue that they are complementary approaches to the same

broader construct of well-being (Herd, 2022; Ryan & Deci, 2001; Strelhow et al., 2020). This has led to the use of different measurement instruments and different theoretical approaches, given that their origins also come from different philosophical traditions. Thus, SWB derives from the hedonic tradition revolving around the concept of pleasure (what is pleasurable generates well-being), whereas PWB derives from the eudaimonic tradition, according to which what is really important is to feel fulfilled as human beings. To the latter end, what brings well-being is the achievement of important life goals, regardless of whether this generates greater pleasure or not.

Bearing the above considerations in mind, the aims of this work are three-fold. Firstly, to determine whether there is a decrease in the levels of SWB and PWB (measured through various indicators and including a global indicator of SWB, referred to as OLS) from one year to the next. The data are also assumed to be nested, since they were collected from different schools, leading to the second aim: to examine the influence of each particular school on its students' overall SWB, in addition to the effects of gender and age. The third and final aim is to identify potential non-linear relationships between SWB, measured globally, and other indicators of SWB and PWB.

Method

Sample

This study considers data corresponding to the first two collections of a larger longitudinal study carried out in Spain in 2018 and 2019 (pre-pandemic). Due to the difficulty of obtaining the collaboration of primary and secondary schools over several consecutive school years, the data were collected by means of non-random sampling from schools that showed an interest in participating.

The same 994 Catalan-speaking students from 20 schools, whose parents had previously signed an informed consent form, participated in the two consecutive data collections analysed here. Eighteen of the schools were state-run and

two were partially-subsidized private; all were located in the province of Girona (Catalonia, north-east of Spain), distributed among four different municipalities. Fourteen of the schools offered primary education and six offered secondary. Eighteen were in urban contexts (more than 10,000 inhabitants) and two in semi-urban contexts (between 2,000 and 10,000 inhabitants). The primary and secondary schools varied greatly in size. It is worth bearing in mind that in the Spanish education system, the transition from primary to secondary school takes place in the year in which the student turns 12. No exam is required to change levels. However, and in the case of the public system, for most students this means changing schools and, in some cases, even having to commute to a larger municipality. Moreover, the organization of primary education is very different from that of secondary education. In the latter, there are more teachers and subjects, and the tutor spends less time with the students.

In 45.3% of the cases, the participants identified themselves as male and in the other 54.7% as female. The mean age from the 1st year of data collection was 12.09 (SD = 1.631) and that of the 2nd year 12.98 years (SD = 1.634) (Table 1).

Instruments

The instruments used for both the 1st and 2nd data collections were as follows:

Overall satisfaction scale (OLS)

The importance of including a single item scale on overall satisfaction when studying SWB was highlighted by Campbell et al. as early as 1976. A question on satisfaction with life considered globally has been included in this study using a scale from 0 to 10, with 0 meaning not at all satisfied and 10 totally satisfied.

Brief multidimensional student life satisfaction scale (BMSLSS)

This scale was initially developed for use with students between 8 and 18 years of age (Seligson et al., 2003). It includes five specific items referring to life satisfaction domains. Responses were originally coded on a scale from 1 to 7 (with labels ranging from “Terrible” to “Delighted”), but this was replaced by a 0–10 scale to make it more sensitive. Each of the values on the scale has been labelled, describing satisfaction with each of the domains covered (family, friends, student experience, self and place of living), from “Terrible” to “Delighted”.

Table 1 Age (in years) and gender of the 994 participants in the 1st data collection

	Boy	Girl	Total
10	101	104	205
11	103	116	219
12	80	95	175
13	83	105	188
14	46	63	109
15	32	51	83
16	5	10	15
Total	450	544	994

Positive affect scale (PA) and negative affect scale (NA)

Based on the Core Affect Scale (Russell, 2003; Barrett & Russell, 1998), five items on positive affect (active/energetic, happy, satisfied, fortunate and excited) and three on negative affect (stressed, sad and worried) were included in our questionnaire. This selection was taken from a broader list of affect items previously tested in other studies with Catalan-speaking students (see González-Carrasco et al., 2017b), in which those that were either not too comprehensible for children and adolescents or did not contribute much to the analyses were discarded. The question was formulated as follows: “When you think about your life in a general way, does the following group of sensations describe how you feel?” Responses comprised a unipolar scale from 0 (Not at all) to 10 (Very clearly).

Children’s worlds psychological subjective well-being scale (CW-PSWBS)

The six-item CW-PSWB psychometric scale CW-PSWB was used to measure psychological well-being (PWB), based on Ryff’s (1989) model (see Nahkur & Casas, 2021). Responses were collected using an 11-point unipolar scale, with 0 labelled “Disagree” and 10 “Strongly agree”, for the following items: “I like being the way I am”, “I am good at managing my daily responsibilities”, “People are generally friendly towards me”, “I have enough choice about how I spend my time”, “I feel that I am learning a lot at the moment”, and “I feel positive about my future”.

Procedure

The questionnaire was self-administered at the primary/secondary school (on paper or in an electronic version, at the convenience of each school), with the presence of a researcher, who explained the aims to all students equally and answered any questions raised by them. Participants were asked to participate and were free to refuse at any time. They were also informed of the confidentiality of their responses.

Data analysis

The data analysis is divided into two distinct sections. The first accounts for the first objective through its application of the Student’s t-test to all of the indicators used here - both SWB items (OLS, BSMMLSS items and Positive and Negative Affect items) and PWB items (CW-PSWBS) - to explore variations in related samples from one year to the next. In the second section, and to account for objectives two and three, generalized additive models (GAM) with

multiple quantitative and qualitative predictors were used, with the OLS as the dependent variable.

The main advantage of GAM models is their ability to model highly complex non-linear relationships when the number of potential predictors is large. This allowed us to explore the explanatory capacity of different SWB and PWB items in greater depth and account for the overall SWB indicator (the OLS), as well as to identify potential non-linear relationships between these (Objective 3). They also helped with exploring the role that belonging to one school or another, as well as age and gender, play in this explanation (Objective 2).

To this end, the restricted maximum likelihood method (REML) was used to obtain stable results in terms of the selection of the smoothing parameter, without manually setting this parameter. The GAM function was also allowed to automatically select the number of base functions and then evaluate whether the model was sufficiently well adjusted in this respect. To compare the goodness of fit of different possible models, three separate models were tested, one for each of the scales including SWB items (the BSMMLSS and the Positive and Negative Affect scale) and PWB items (the CW-PSWBS), and, finally, a fourth model including all of these indicators to account for OLS. The same procedure was applied separately for the data collected in the 1st and 2nd years.

Effective degrees of freedom (edf) were used as a proxy for the degree of non-linearity of the parameters within the GAM models tested in relation to the dependent variable (the OLS). Values greater than 1 indicate the presence of non-linearity, and the greater the distance from this value, the greater the non-linearity. The decision regarding the most suitable model was made considering the AIC value of each model (the lower the better). Finally, the chosen models were diagnosed using the p-values of the k-index for each parameter and by graphically plotting the residuals through the Loess (locally weighted scatterplot smoothing) regression technique, which uses local weighted regression to fit a smooth curve through points on a scatter plot. All calculations were made using the 4.2.2. version of the Rstudio software.

Results

Student’s T-Test for two related samples (1st and 2nd years of data collection)

This first section of results addresses the first objective of this article, which was formulated as testing whether a decline in well-being scores is observed from one year to the next in the period between 10 and 16 years of age, as

measured by indicators of subjective well-being (SWB) (including the OLS as a global measure) and psychological well-being (PWB).

Regarding the results for OLS, the mean observed for the 2nd year ($M_2=8.26$) was lower than that for the 1st year ($M_1=8.43$); this difference was statistically significant but with a low effect size ($t(959)=3.16$, $p<0.001$, $d=0.10$). The mean scores for the items on the BMSLSS was lower for the 2nd year, except for satisfaction with friends and with the student experience. However, this difference only turned out to be statistically significant for satisfaction with the family ($M_1=8.76$, $M_2=8.64$, $t(961)=2.30$, $p=0.02$, $d=0.07$), albeit with a very low effect size. According to the results of the t-test, there was a decrease in all positive affects (active, happy, satisfied, fortunate and excited) and an increase in negative affects (sad, worried), except for stressed, which decreased. The change reached statistical significance, although only for active ($M_1=8.42$, $M_2=8.16$, $t(978)=4.57$, $p<0.001$, $d=0.15$) and happy ($M_1=8.69$, $M_2=8.43$, $t(981)=5.10$, $p<0.001$, $d=0.17$). The effect size was low for the two mentioned affects.

A statistically significant decrease was also observed in four of the items on the CW-PSWBS (“I like being the way I am”: $M_1=8.73$, $M_2=8.52$, $t(944)=3.43$, $p<0.001$, $d=0.11$; “People are generally friendly towards me”: $M_1=8.29$, $M_2=8.17$, $t(964)=1.97$, $p=.04$, $d=0.07$; “I feel that I am learning a lot at the moment”: $M_1=8.07$, $M_2=7.71$, $t(961)=5.70$, $p<.001$, $d=0.16$; and “I feel positive about my future”: $M_1=8.44$, $M_2=8.19$, $t(963)=3.76$, $p<0.001$, $d=0.12$), with very low to low effect size. A decrease was also identified for the item “I am good at managing my daily responsibilities”, although statistical significance was not reached. Finally, an increase was observed for the item “I have enough choice about how I spend my time”, although without reaching statistical significance.

Additive GAM models with multiple quantitative and qualitative predictors

The second section of the results addresses the second and third objectives of this article, which are to examine the contribution of primary/secondary school, gender, and age in explaining global SWB; and to identify potential nonlinear relationships between global SWB and other indicators of SWB and PWB.

1st year of data collection

The first model (SAT_GLOB11) included the items from the BMSLSS (which measures the cognitive dimension of SWB) as explanatory variables and corresponded to the 1st data collection. The primary or secondary school, gender

and age of the participants were also included. According to the results obtained, neither the primary/secondary school, age nor gender contributed to explaining OLS in this model. With respect to the BMSLSS items to which a smoothing was introduced to identify non-linear relationships, we observed that four of them reached statistical significance, all with an edf value greater than 1, which indicates the existence of non-linear relationships between them and OLS. These were: satisfaction with family (edf=3.45, $p<.001$); satisfaction with friends (edf=1.17, $p=.03$); satisfaction with oneself (edf=1.73, $p<.001$); and satisfaction with the place where you live (edf=2.48, $p<.001$). Among these items, the one that showed the highest non-linear relationship with OLS was satisfaction with the family, since it showed the highest edf.

The second model tested (SAT_GLOB21) differed from the first by including the Positive and Negative Affect items that measure the affective dimension of SWB. We again observed that neither the primary/secondary school nor age or gender were explanatory variables for the response variable OLS. Among the positive affect items, we observed the following that reached statistical significance: happy (edf=2.10, $p<.001$); satisfied (edf=2.85, $p<.001$); and fortunate (edf=3.74, $p<.001$). In contrast, only one of the three negative affect items, sad (edf=1.00, $p=.04$), displayed a relevant effect, maintaining a linear relationship with OLS, unlike the positive affect items.

For the third model (SAT_GLOB OLS31), the CW-PSWBS items were included. All of them showed a statistically significant contribution, except for the item “I feel that I am learning a lot at the moment”. They were as follows: “I like being the way I am” (edf=1.00, $p=.01$); “I am good at managing my daily responsibilities” (edf=1.01, $p<0.001$); “People are generally friendly towards me” (edf=2.29 $p<0.001$); “I have enough choice about how I spend my time” (edf=1.00, $p=0.002$); and “I feel positive about my future” (edf=1.00, $p<0.001$). Of these, “People are generally friendly towards me” showed the least linear relationship with the OLS response variable. In this case, gender and primary/secondary school, but not age, turned out to be explanatory variables.

The fourth model (SAT_GLOB41) included a combination of the previous scales. When comparing the percentage of variance explained for each of the models calculated using the data corresponding to the 1st data collection, we observed that the one with the highest % was precisely the model that combined the three scales (48.7%), with some distance with respect to the one that considered only the affect scale (45.3%), the CW-PSWB (31.3%) and the BMSLSS (31.4%).

However, to ensure that the more complex model provided more information, we compared the AIC value for

each of the four estimated models, noting that the lowest value corresponded to the most complex model (Table 2), so this is the one that was chosen. It is interpreted in more detail below.

In this fourth model, we observed that, once again, neither age, gender nor the primary/secondary school made a relevant contribution, while only one of the BMSLSS items (satisfaction with the place where you live: $edf=1.00$, $p < 0.001$) (with a linear relationship with the OLS response variable) reached statistical significance, and none of the CW-PSWBS items did. This result contrasted with the fact that Affect items (3 PA and 1 NA) showed a relevant effect, all of them maintaining non-linear relationships. They were as follows: happy ($edf=1.98$, $p < 0.001$); satisfied ($edf=2.32$, $p < 0.001$); fortunate ($edf=1.55$, $p < 0.001$); and sad ($edf=3.15$, $p=0.02$). Figure 1 shows that, although the

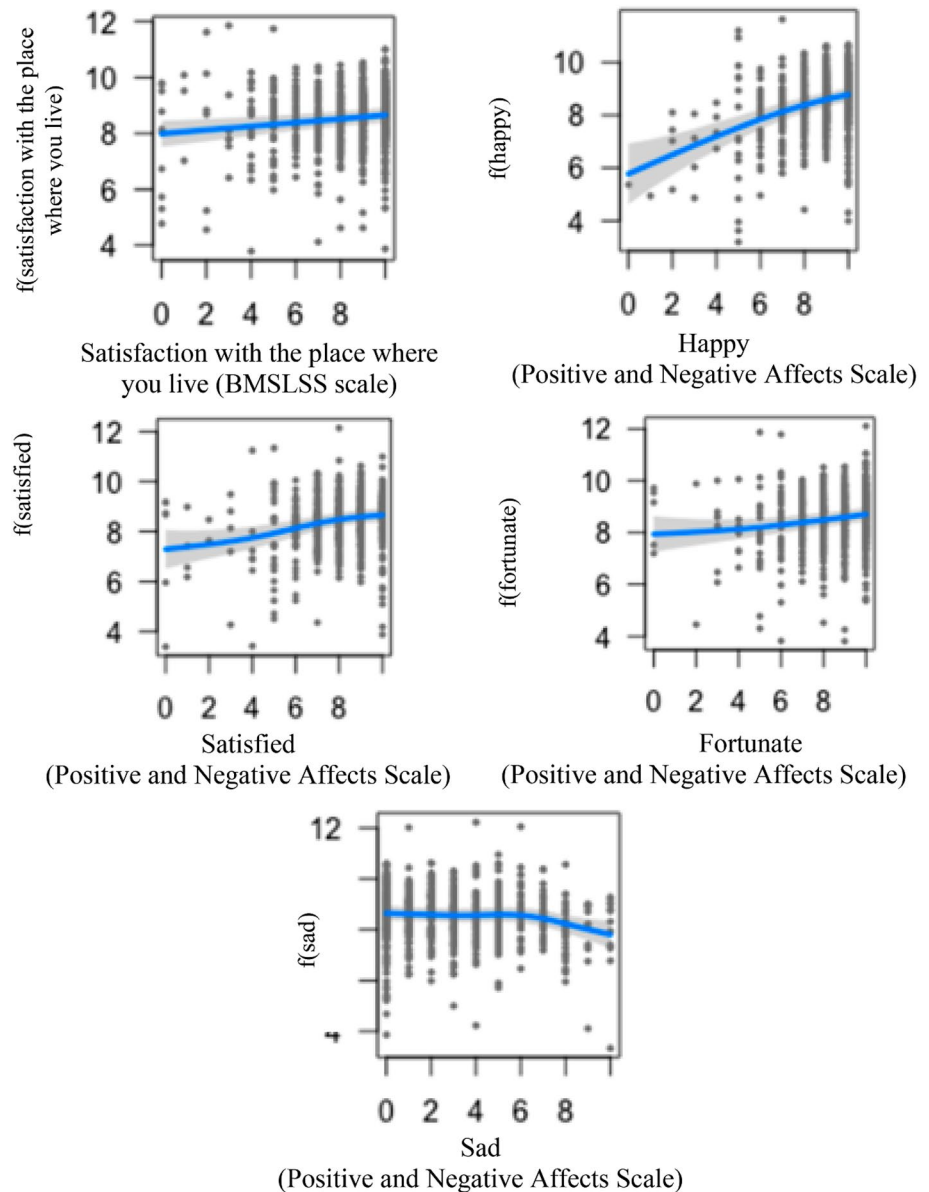
Table 2 AIC values for the four models calculated using the data collected in the 1st year

	df*	AICs**
SAT_GLOB11	35.17208	3155.151
SAT_GLOB21	42.19206	2735.207
SAT_GLOB31	32.27039	3094.732
SAT_GLOB41	58.31564	2461.051

Note *degrees of freedom/**The Akaike information criterion

fit curves were not particularly steep for predictors showing non-linear relationships (4 out of 5, since satisfaction with the place where you live maintains a linear relationship), they were curved in all cases.

Fig. 1 Visual representation of the partial effects of statistically significant predictors for the SAT_GLOB41 model in the 1st year of data collection (only graphs for statistically significant items are shown)



2nd year of data collection

For the analysis of the data collected in the 2nd year, we proceeded as in the previous section, testing the respective models for the same scales. In the case of the model that only included the BMSLSS items, age, primary/secondary school and gender (SAT_GLOB12), we observed that all of the items made a statistically significant contribution to explaining the 2nd year OLS values, while this did not occur with the two qualitative explanatory variables and with age. The edf values were as follows: satisfaction with family (5.66, $p < 0.001$); satisfaction with friends (1.57, $p < 0.001$); satisfaction with the student experience (1.00, $p < 0.001$); satisfaction with oneself (3.31, $p < 0.001$); and satisfaction with the place where you live (2.28, $p = 0.03$). While the relationship between satisfaction with the student experience and OLS was linear, non-linear relationships were observed for the rest, especially satisfaction with the family and oneself.

Three Affect items contributed to explaining OLS in the SAT_GLOB22 model: happy (edf=3.75, $p < 0.001$); satisfied (edf=2.55, $p < 0.001$); and fortunate (edf=1.00, $p < 0.001$), with linear relationships observed only for the last one. Neither age, gender nor the primary/secondary school in which they were enrolled reached statistical significance. All of the items in the SAT_GLOB32 model, carried out using the CW-PSWBS, made a statistically significant contribution, with the exception of “I am good at managing my daily responsibilities”, the following maintaining linear relationships with the response variable: “I like being the way I am” (edf=1.00, $p < 0.001$); “People are generally friendly towards me” (edf=1.00, $p < 0.001$); and “I feel positive about my future” (edf=1.00, $p < 0.001$), and others nonlinear relationships: “I have enough choice about how I spend my time” (edf=2.08, $p < 0.001$); and “I feel that I am learning a lot at the moment” (edf=4.34, $p = 0.04$). The school type did not contribute to the model, nor did gender or age.

Finally, and in relation to the model that included the three scales (SAT_GLOB42), we observed that neither age, gender nor the primary/secondary school played a relevant role, while six of the nineteen predictors used made a notable contribution. They were as follows (Fig. 2): satisfaction with family (edf=5.74, $p < 0.001$); satisfaction with friends

(edf=2.60, $p = 0.04$); active (edf=1.00, $p = 0.01$); happy (edf=3.69, $p < 0.001$); satisfied (edf=1.97, $p < 0.001$); fortunate (edf=2.47, $p < 0.001$); “I am good at managing my daily responsibilities” (edf=4.62, $p = 0.001$); and “I have enough choice about how I spend my time” (edf=1.19, $p < 0.001$). In all cases, with the exception of feeling active, edf values suggested that non-linear relationships existed, but of a different nature, as the range of edf values varied notably.

Comparison of the models tested using the data obtained in the 2nd year showed that, similarly to the data collected for the 1st year, the model with the highest % of explained variance was the one that combined the three scales (59.1%), with some distance with respect to the one that considered only the Affect scale items (51%), the CW-PSWB (37.1%) and the BMSLSS items (37.1%). The AIC value of the most complex model was the lowest (Table 3), suggesting it was the best. It should also be noted that the R^2 value was higher for the models calculated with the data from the 2nd collection than those from the 1st.

Figure 2 shows that, although the fit curves were not particularly steep (except for satisfaction with the family), they were curved in all cases, with the exception of active, meaning all predictors within this model showed non-linear relationships with OLS.

Diagnosis of the selected GAM models

Finally, we proceeded to the diagnosis of the two models selected in the previous sections to determine whether the data were being fitted well, starting with the model built from the 1st data collection (SAT_GLOB41). First, we noted that the p-values were high for all indicators (Table 4), which told us that the residuals were randomly distributed, this being a positive indicator that sufficient basis functions were being fitted. Secondly, we explored the residual plots to establish normality, homogeneity and linearity (Fig. 3).

In the upper-left graph, we observed that the residuals were linear, since the loess regression (red curve) of the residuals and the predicted values followed more or less a straight line that almost overlapped with the zero value of the y-axis. In the upper-right graph, we observed that the residuals were not normal, since many values did not fit the intervals around the diagonal. In the lower-left graph, we could observe that there was more or less equal variance in the residuals. And finally, in the lower-right graph we noted that there were no outliers, since there was no value that made the loess curve fitting deviate in particular, being more or less parallel to the X-axis.

Thirdly, we calculated the concurvity in order to observe how much of each smoothing was predetermined by the other smoothings. Since the values were generally high

Table 3 AIC values for the four models calculated with the data collected in the 2nd year

	df*	AICs**
SAT_GLOB12	39.53130	3210.451
SAT_GLOB22	42.89815	2815.267
SAT_GLOB32	37.65882	3154.154
SAT_GLOB42	82.69611	2564.569

Note *degrees of freedom/**The Akaike information criterion

Fig. 2 Visual representation of partial effects of the statistically significant predictors for the SAT_GLOB42 model in the 2nd data collection (only graphs for the statistically items are shown)

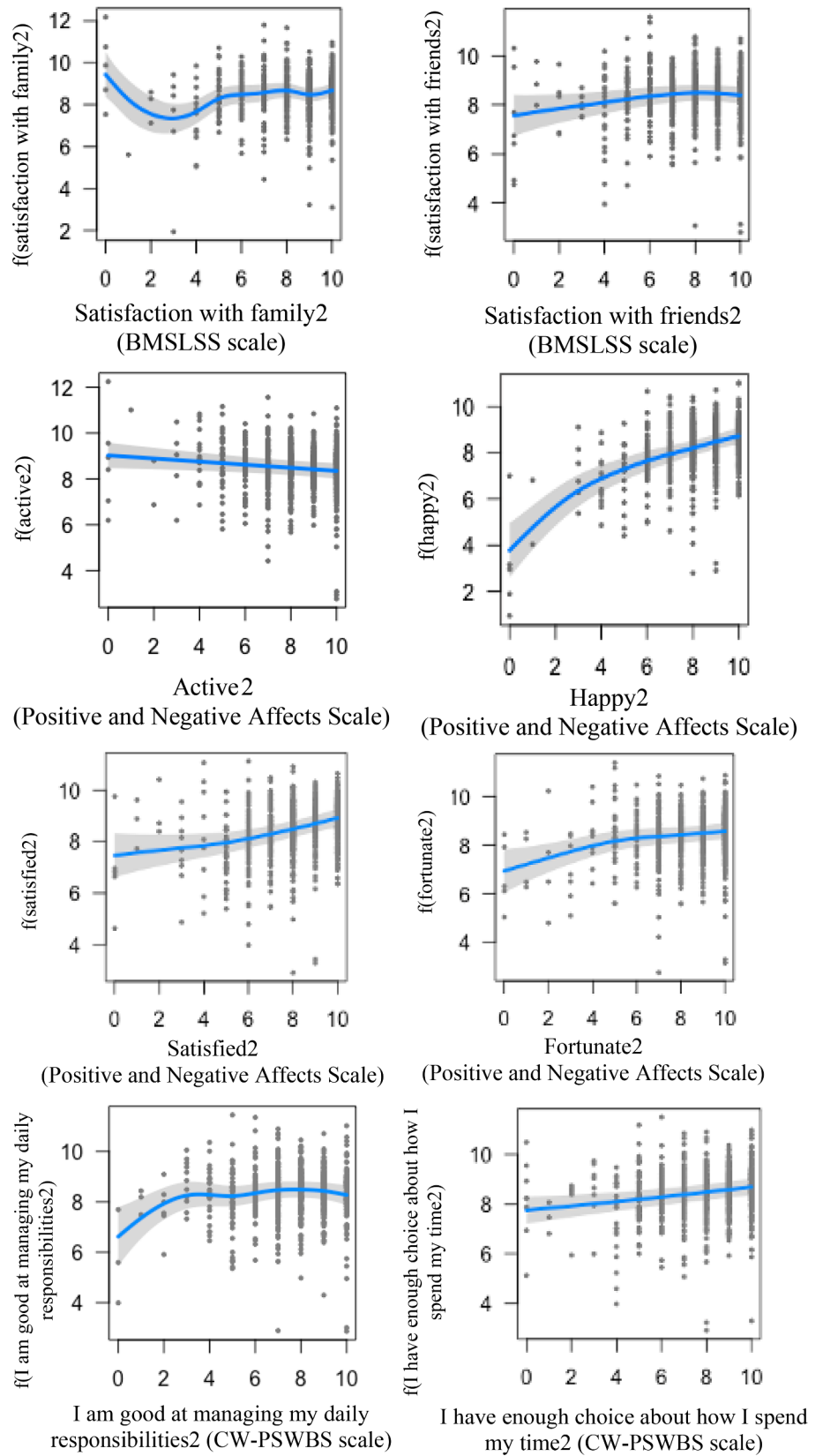


Table 4 Values of the k-index for the explanatory variables to which the smoothing term was applied (SAT_GLOB41 model with data from the 1st year of data collection)

	k'	edf	k-index	p-value
Satisfaction with family (BMSLSS scale)	9.00	2.68	0.99	0.37
Satisfaction with friends (BMSLSS scale)	9.00	1.00	1.07	0.96
Satisfaction with the student experience (BMSLSS scale)	9.00	1.41	1.00	0.42
Satisfaction with oneself (BMSLSS scale)	9.00	1.94	1.08	0.99
Satisfaction with the place where you live (BMSLSS scale)	9.00	1.00	1.00	0.54
Active (Positive and Negative Affects Scale)	9.00	1.00	1.00	0.52
Happy (Positive and Negative Affects Scale)	9.00	1.98	1.10	1.00
Satisfied (Positive and Negative Affects Scale)	9.00	2.32	1.02	0.78
Fortunate (Positive and Negative Affects Scale)	9.00	1.55	1.06	0.95
Stressed (Positive and Negative Affects Scale)	9.00	2.20	1.00	0.46
Sad (Positive and Negative Affects Scale)	9.00	3.15	1.02	0.66
Worried (Positive and Negative Affects Scale)	9.00	1.00	1.04	0.85
Excited (Positive and Negative Affects Scale)	9.00	1.22	1.09	1.00
I like being the way I am (CW-PSWBS scale)	9.00	1.40	0.99	0.34
I am good at managing my daily responsibilities (CW-PSWBS scale)	9.00	1.00	1.00	0.53
People are generally friendly towards me (CW-PSWBS scale)	9.00	1.35	1.04	0.87
I have enough choice about how I spend my time (CW-PSWBS scale)	9.00	1.00	1.02	0.69
I feel that I am learning a lot at the moment (CW-PSWBS scale)	9.00	1.73	1.04	0.82
I feel positive about my future (CW-PSWBS scale)	9.00	1.00	0.97	0.17

(Table 5), we proceeded to perform the same analysis, but this time by pairs of variables. In contrast, the pairwise analysis showed us that the values were low, which indicated that the explanatory power of a single predictor over another was low and that it was the sum of different predictors over the individual predictors that led to high concurrency values in general.

Also, the p-values were high for all indicators included in the SAT_GLOB42 model (Table 6), indicating that the residuals were randomly distributed, which is positive evidence that sufficient basis functions were being fitted. Below that, we show the different graphs of residuals (Fig. 4). The same fit and concurrency data were observed with respect to those

collected in the 1st year (Table 7), which led us to conclude that the fit of the two models was acceptable.

Discussion

This study was based on three objectives. The first was to explore whether there was a decrease in the levels of SWB and PWB from the 1st to 2nd years of data collection among children and adolescents aged 10 to 16. We observed that this decrease, a trend that has been previously considered as a “developmental phenomenon” (Goldbeck et al., 2007), reached statistical significance in relation to OLS, although the effect size was not very high, in line with previous research (Casas & González-Carrasco, 2020b).

We also found a general downward trend in most of the positive indicators and an increase in most of the negative indicators. However, at one year term, statistically significant changes were observed only in one of the items of the BMSLSS (satisfaction with family), in two items on the Positive and Negative Affect scale (active and happy), and in four of the six CW-PSWBS items (“I like being the way I am”, “People are generally nice to me”, “I feel I am learning a lot right now” and “I feel positive about my future”). A statistically significant decrease in satisfaction with family was also observed by Tiliouine et al. (2019) after a two-year follow-up study of 443 Algerian children aged 12 (Time 1) to 14 (Time 2). According to the authors, these results could reflect the changes that occur in adolescence with respect to family relationships. Satisfaction with friends was not found to change significantly in either Tiliouine et al.’s study (2019) or the present one.

Tiliouine et al. (2019) also pointed out a statistically decreasing-with-age trend for positive affect and PWB indicators, using the same instruments as here, but measured globally, that is, without focusing on each indicator separately. A low temporal stability in SWB has also been observed by Katsantonis et al. (2022) in a sample of 11,231 UK adolescents surveyed in the *Millenium Cohort Study* at ages 11 (Time 1) and 14 (Time 2), and by Uusitalo-Malmivaara (2014) in a sample of 339 Finnish students aged 12 (Time 1) and 15 (Time 2), respectively.

Although these changes should be explored in more detail in the future, taking into account the interaction between gender and age, this finding reaffirms the importance of including scales of different types in this field of study (see Casas & González-Carrasco, 2021a), given that the scale that measures PWB turned out to be more sensitive to the passing of time than the two scales that assess SWB. In fact, the one that measures the affective dimension was found to be more sensitive than the one measuring the cognitive dimension.

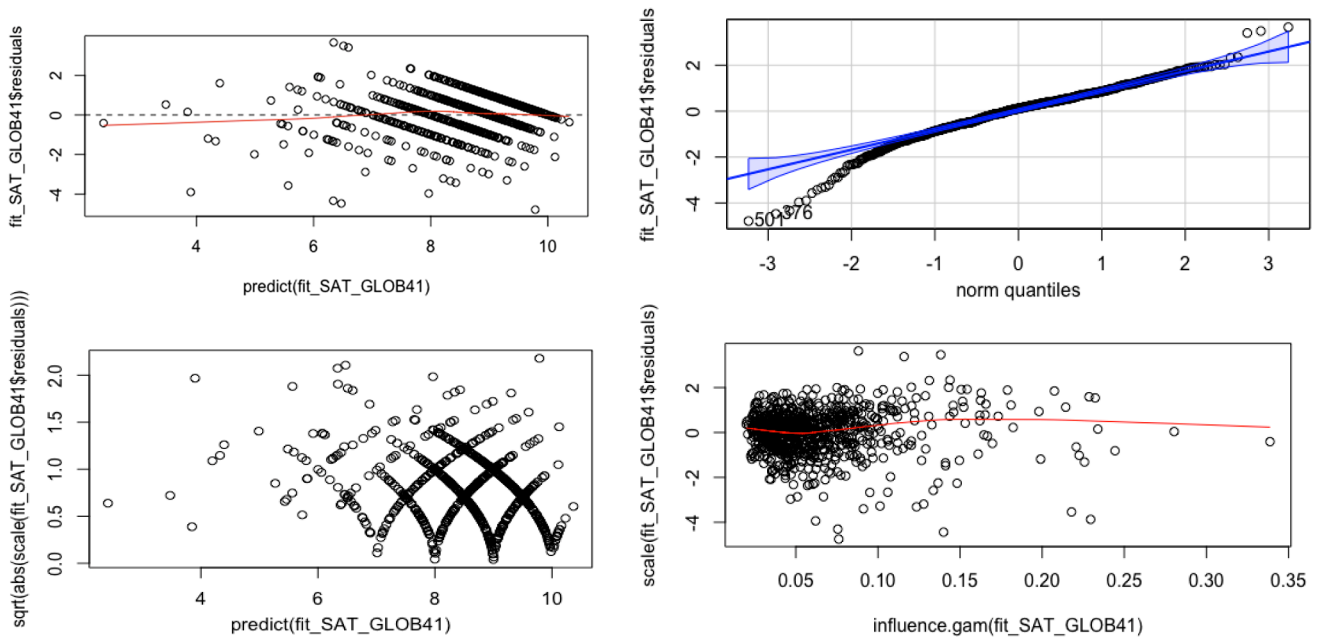


Fig. 3 Residual plots for the SAT_GLOB41 model (1st year of data collection). *Note* sqrt: square root

Table 5 Concurrency values for the explanatory variables to which the smoothing term was applied (SAT_GLOB41 model with data from the 1st year of data collection)

para	Satisfaction with family (BMSLSS scale)	Satisfaction with friends (BMSLSS scale)	Satisfaction with the student experience (BMSLSS scale)	Satisfaction with oneself (BMSLSS scale)	Satisfaction with the place where you live (BMSLSS scale)	Active (Positive and Negative Affects Scale)
Worst	0.99501004	0.7101937	0.7905803	0.6104419	0.7161814	0.6832279
Observed	0.9951004	0.5484171	0.5803724	0.4864894	0.6980088	0.5980666
Estimate	0.9951004	0.6178440	0.5609013	0.5445126	0.6768801	0.5606202
	<i>Happy (Positive and Negative Affects Scale)</i>	<i>Satisfied (Positive and Negative Affects Scale)</i>	<i>Fortunate (Positive and Negative Affects Scale)</i>	<i>Stressed (Positive and Negative Affects Scale)</i>	<i>Sad (Positive and Negative Affects Scale)</i>	<i>Worried (Positive and Negative Affects Scale)</i>
Worst	0.8804383	0.8006556	0.5804250	0.5324416	0.6031086	0.5347983
Observed	0.7543692	0.6421486	0.5531327	0.4611210	0.5190066	0.3539550
Estimate	0.7066335	0.6039192	0.5430746	0.4991099	0.5520325	0.5413035
	<i>I like being the way I am (CW-PSWBS scale)</i>	<i>I am good at managing my daily responsibilities (CW-PSWBS scale)</i>	<i>People are generally friendly towards me (CW-PSWBS scale)</i>	<i>I have enough choice about how I spend my time (CW-PSWBS scale)</i>	<i>I feel that I am learning a lot at the moment (CW-PSWBS scale)</i>	<i>I feel positive about my future (CW-PSWBS scale)</i>
Worst	0.9147047	0.6776565	0.8147904	0.6087519	0.6711443	0.7045561
Observed	0.5833190	0.6294765	0.6298299	0.4735890	0.5294848	0.6532716
Estimate	0.6153344	0.5834058	0.5950782	0.4570156	0.5725073	0.6289471

This observation constitutes a novel contribution of this study insofar as there are very few longitudinal studies in this field and even fewer that include such a variety of scales. Among the few existing exceptions (see, for instance, Kassis et al., 2022; Katsantonis et al., 2022; Tiliouine et al., 2019), the results of the current study contrasts with those of a recent one observing stability in PWB levels among a sample of Spanish adolescents aged 14 to 16, surveyed

twice (Gómez-López et al., 2022). However, the latter study was carried out using a different scale, a shorter amount of time (six months) between the first and second measure and an older sample.

The effect size being so low in all cases can be explained by the fact that the means between the two data collections did not differ to any great degree, which leaves the debate between stability-change in the evolution of SWB and PWB

Table 6 Values of the k-index for the explanatory variables to which the smoothing term was applied (SAT_GLOB42 model with data from the 2nd year of data collection)

	k'	edf	k-index	p-value
Satisfaction with family2 (BMSLSS scale)	9.00	5.74	0.99	0.35
Satisfaction with friends2 (BMSLSS scale)	9.00	2.92	1.04	0.89
Satisfaction with the student experience2 (BMSLSS scale)	9.00	5.76	1.07	0.96
Satisfaction with oneself2 (BMSLSS scale)	9.00	2.60	1.05	0.91
Satisfaction with the place where you live2 (BMSLSS scale)	9.00	1.00	1.01	0.57
Active2 (Positive and Negative Affects Scale)	9.00	1.00	1.04	0.92
Happy2 (Positive and Negative Affects Scale)	9.00	3.69	1.01	0.55
Satisfied2 (Positive and Negative Affects Scale)	9.00	1.97	0.99	0.27
Fortunate2 (Positive and Negative Affects Scale)	9.00	2.47	1.08	0.99
Stressed2 (Positive and Negative Affects Scale)	9.00	3.27	1.05	0.94
Sad2 (Positive and Negative Affects Scale)	9.00	1.00	1.00	0.52
Worried 2 (Positive and Negative Affects Scale)	9.00	1.68	1.01	0.49
Excited2 (Positive and Negative Affects Scale)	9.00	1.00	0.98	0.30
I like being the way I am2 (CW-PSWBS scale)	9.00	1.00	1.12	1.00
I am good at managing my daily responsibilities2 (CW-PSWBS scale)	9.00	4.62	0.99	0.28
People are generally friendly towards me2 (CW-PSWBS scale)	9.00	2.10	1.07	0.97
I have enough choice about how I spend my time2 (CW-PSWBS scale)	9.00	1.19	1.02	0.71
I feel that I am learning a lot at the moment2 (CW-PSWBS scale)	9.00	4.13	0.97	0.19
I feel positive about my future2 (CW-PSWBS scale)	9.00	2.69	1.01	0.58

from late childhood to early adolescence open to further debate. Even so, the results obtained can help us select only those indicators more sensitive to change to monitor SWB and PWB in the best way and with the minimum number of indicators possible in future research.

Regarding the second objective, that of investigating the contribution the school, gender and age may play in explaining SWB, measured globally, we have seen that none of these variables made a statistically significant contribution to explaining OLS values for any of the models calculated using data from the 1st or 2nd year. The only exception to this was the model including the CW-PSWBS5 items in the 1st year (SAT_GLOB31), for which gender

and primary/secondary school did make some contribution. This is despite the fact that age and gender are highlighted as contributing variables in the scientific literature and that the type of school was also expected to play a relevant role due to the so-called “school effect” identified in other fields of research. This same lack of “school effect” in children’s well-being has been documented by a few previous studies, however (see Herke et al., 2019; Konu et al., 2002).

The most plausible explanation for the above is that these three variables, despite stand out as relevant in the scientific literature, lose explanatory capacity when other indicators that display a more relevant contribution are included in the data analysis. In fact, the same phenomenon was observed with some SWB and PWB items when testing the models that combine the three scales together: some of the items that made an important contribution in the partial models (including only one scale) were no longer relevant for the global models.

Another important issue worth highlighting is the lack of a global measure of PWB comparable to that of OLS in relation to satisfaction with specific life domains. Casas and González-Carrasco (2021b) have previously used the item on satisfaction with meaning in life as a measure of this kind, which showed strong correlations with both hedonic and eudaimonic well-being among adolescents. This indicator was also available for the present longitudinal study, but only for the oldest participants, and not enough responses were therefore obtained to allow it to be used to run all the models calculated here. This led us to use OLS as a global indicator of SWB, even though conceptually it has always been considered an indicator of the cognitive dimension of SWB. The fact that different indicators of PWB contribute to explaining OLS scores in the different models calculated leads us to think that it is increasingly difficult to sustain the consideration of SWB and PWB as totally independent constructs (see Strelhow et al., 2020, for a proposed integrative model).

The third objective of this work was to identify potential non-linear relationships between OLS and specific items on the SWB and PWB scales. The results obtained through GAM models highlighted several issues. Firstly, the important role played by Affect in explaining SWB globally, regardless of the year of data collection, an issue that has been increasingly highlighted in the literature (see Casas & González-Carrasco, 2020b; Davern et al., 2007) but which is yet to be sufficiently taken into account. Specifically, in the two years of data collection, most of the SWB and PWB indicators that turned out to be statistically significant (SAT_GLOB41 and SAT_GLOB42) corresponded to the Positive and Negative Affect Scale, and the three items that coincided in the two models tested for each of the two years were part of the Affect scale (happy, satisfied and fortunate).

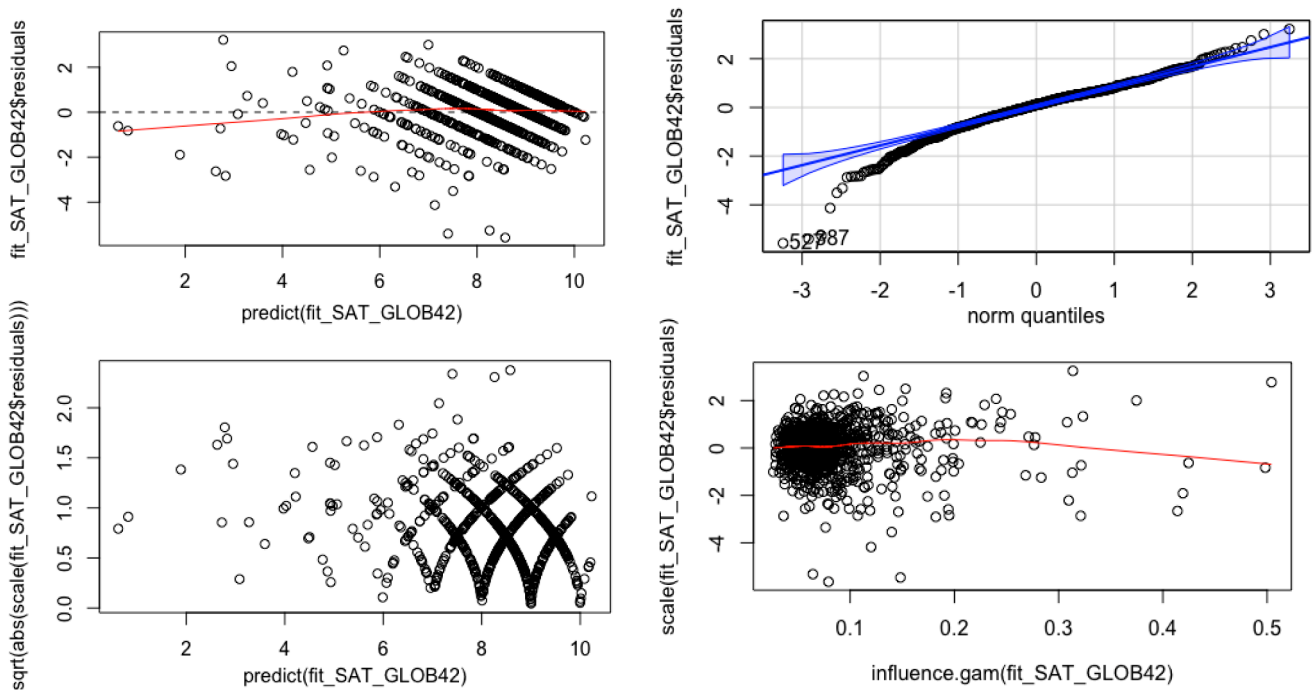


Fig. 4 Residual plots for the SAT_GLOB42 model (2nd year of data collection). *Note* sqrt: square root

Table 7 Concurrency values for the explanatory variables to which the smoothing term was applied (SAT_GLOB42 model with data from the 2nd year of data collection)

	para	<i>Satisfaction with family2 (BMSLSS scale)</i>	<i>Satisfaction with friends2 (BMSLSS scale)</i>	<i>Satisfaction with the student experience2 (BMSLSS scale)</i>	<i>Satisfaction with oneself2 (BMSLSS scale)</i>	<i>Satisfaction with the place where you live2 (BMSLSS scale)</i>	<i>Active2 (Positive and Negative Affects Scale)</i>
Worst	0.9943987	0.7953247	0.7592899	0.7495117	0.7803794	0.7535991	0.7952630
Observed	0.9943987	0.4672552	0.7039308	0.5136029	0.6983145	0.4527298	0.6115683
Estimate	0.9943987	0.5844098	0.5180779	0.6136801	0.6852014	0.4343819	0.5671814
	<i>Happy2 (Positive and Negative Affects Scale)</i>	<i>Satisfied2 (Positive and Negative Affects Scale)</i>	<i>Fortunate2 (Positive and Negative Affects Scale)</i>	<i>Stressed2 (Positive and Negative Affects Scale)</i>	<i>Sad2 (Positive and Negative Affects Scale)</i>	<i>Worried2 (Positive and Negative Affects Scale)</i>	<i>Excited2 (Positive and Negative Affects Scale)</i>
Worst	0.8350876	0.7543144	0.6712606	0.5670524	0.6716151	0.6439977	0.5304860
Observed	0.7925713	0.6786225	0.6257857	0.3254001	0.6515269	0.4870689	0.3705960
Estimate	0.7502266	0.6408512	0.5612365	0.5195476	0.6039560	0.5886454	0.3787239
	<i>I like being the way I am2 (CW-PSWBS scale)</i>	<i>I am good at managing my daily responsibilities2 (CW-PSWBS scale)</i>	<i>People are generally friendly towards me2 (CW-PSWBS scale)</i>	<i>I have enough choice about how I spend my time2 (CW-PSWBS scale)</i>	<i>I feel that I am learning a lot at the moment2 (CW-PSWBS scale)</i>	<i>I feel positive about my future2 (CW-PSWBS scale)</i>	
Worst	0.7247402	0.7127246	0.6789897	0.6998469	0.6732184	0.6877541	
Observed	0.6668624	0.5863241	0.5618517	0.5384014	0.4414765	0.5988011	
Estimate	0.6263888	0.5825984	0.5712487	0.5179707	0.6097986	0.6330967	

Secondly, four of the five indicators that explained OLS in a statistically significant way in the 1st year (SAT_GLOB41) and seven of the eight in the 2nd year (SAT_GLOB42) did so through a non-linear relationship, meaning linear relationships were very residual. This result that could not have been observed through a classic linear regression,

greatly limiting our understanding of the type of relationships maintained by the variables analysed here.

Thirdly, the Affect items always displayed non-linear relationships (with the exception of active in the 2nd year), which points to lesser stability with respect to other more cognitive components, especially during a stage of life in which very important changes occur, such as the one

considered here. Steinmayr et al. (2019) also argued that the cognitive dimension of SWB is more stable than the affective one. This result evidences the limitations of the bottom-up approach, as it is traditionally understood, since the contribution of SWB and PWB items in explaining OLS was clearly not the same.

And finally, five statistically significant predictors were identified in the 1st year compared to eight in the 2nd year. It is possible that greater familiarity with the questions included in the questionnaire in the second year may have increased understanding and the approach to the questions, as well as the fact that the participants were a year older. However, further research should be conducted to corroborate this hypothesis.

The results obtained here have relevant implications for both research and policymaking when it comes to the period of late childhood and early adolescence. In terms of research, they invite scholars to continue investigating developmental changes in SWB and PWB during this life period, since the decrease-with-age trend does not appear to be homogeneous for all components of well-being and may be subject to important cultural differences. From a policymaking point of view, the fact that this decrease coincides with the transition from primary to secondary education implies the need to support this process much more than is done nowadays, focusing on those variables that play the most important role in this decrease, due to the consequences it can have for children and adolescents' well-being.

This study is not exempt of limitations, among them the sample not being very large and located in a specific territory, which can be explained by the difficulty of recruiting a high number of primary and secondary schools in longitudinal data collections. The results are therefore not generalizable. The objectives included testing a global SWB model by articulating different SWB and PWB indicators measured at two points in time and comparing results, while avoiding the most recent measurements (from the 2nd year of data collection) accounting for most of the explained variance. However, future studies could include more sophisticated calculations than the ones described here, such as interaction effects between variables and mixed models, which would allow time to be included as an explanatory variable.

It was beyond the scope of this article to check for individual differences in SWB and PWB trajectories over time according to different socioeconomic and sociodemographic variables, a factor that was taken into account by Chen (2020) and Kassis et al. (2022) and deserves further investigation. Although the aims of this article did not include investigating the structure of children's and adolescents' well-being, the analysis could also be extended in the future with the inclusion of additional instruments, such as a cognitive context-free scale, to determine whether

a tetrapartite model of well-being would be feasible. This would take Savahl et al.'s (2021) quadripartite model as a basis, which includes positive affect, negative affect, cognitive life satisfaction domain-based and cognitive life satisfaction context-free components, and did not originally include a measure of PWB.

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Data availability The data used in this study are not publicly available.

Declarations

Ethical statement The researchers declare that they have complied with all the ethical requirements for this type of study, having received authorization from the educational authorities of the schools and the favourable opinion of the Ethics and Biosafety Committee of the University of Girona (Ref: CEBRU0006-2018). All the children participating in the study had the corresponding informed consent from their legal guardians and they themselves agreed to participate in the study.

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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