

Changes in Emotions from Childhood to Young Adulthood

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Abstract Emotional well-being is particularly important in teenagers and young adults. Childhood and adolescence provide opportunities to develop the foundations for mental health and the school is an important mean that can enable it. It seems important to examine the evolution and differences in positive and negative emotions and experiences in adolescents and young adults in educational settings, which have received less interest in the literature. The main goal of this article (studies 2 and 3), is

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to explore the evolution and age and gender differences in children, adolescents and young adults and to assess on the short-term positive affects in the French school system. A second goal of this article is to assess the validity and reliability of the Scale of Positive and Negative Experience (SPANE, Diener et al. 2010) in French in order to reach our main goal. The SPANE was translated and then evaluated in a sample of 1999 students. Results show adequate psychometric properties of the French version. The results of the second and third studies show that positive emotions decline and negative emotions increase and that women experience on average more negative emotions and less positive emotions than men. The overall results highlight the importance of promoting well-being during adolescence.

Keywords Positive affect · Negative affect · Gender differences · Subjective well-being · Measure

1 Introduction

Emotional well-being is particularly important in young people. Childhood and adolescence provide opportunities to develop the foundations for mental health and prevent mental health problems, and the school is an important mean that can enable it. Moreover, understanding children's well-being have become an important research issue, due to the new and growing attention to this field and to children's social indicators movement and the emerging importance of the subjective perspective (Ben-Arieh 2008). Research show that educational activities produce personal and social outcomes, which are an additional result of cognitive or practical ones. Education institutions have, to a greater or lesser extent, taken account of emotional, affective aspects of students' lives and learning (Ecclestone and Hayes 2009).

The link between positive emotions and subjective well-being is now well established in the literature. Positive emotions signal the presence of optimal well-being, gives new possibilities, bounce back from setbacks, connect with others, and/or become the best version of yourself (Fredrickson 2009, 2013). Being able to savour the positive emotions contributes to well-being in the moment and thereafter (Peterson 2013). Recent data show that positive emotions play as an indicator of the psychological well-being of the adolescent students irrespective of their genders (Rana and Nandinee 2016).

However, this link as well as the evolution of emotions in children and adolescents have been less explored in the literature. Longitudinal studies show age-related changes in emotional experiences. Charles et al. (2001) showed that subjective well-being – closely related to positive affect – increases and negative affect decreases with age among 2804 people ranging in age from 15 to 85 years. However, does this apply specifically to childhood, adolescence and to young adults?

It seems thus important to examine the evolution and differences in positive and negative emotions and experiences in adolescents and young adults in educational settings. Well-being can be considered as the way people evaluate their own lives in terms of cognitive and affective explanations (Diener 2000). The answer to the previous question is twofold, considering the line of research by Lyubomirsky et al. (2005). First

of all, there is a high stake linked to the population's health and well-being and might even lead to better grades. Research shows that happiness, as well as the concomitant experience of frequent positive affect, plays a role in health through its effects on social relationships, healthy behaviour, stress, accident and suicide rates, and coping, as well as possible effects on immune function" (Lyubomirsky et al. 2005). Promoting positive affects at school may thus have an effect on children and adolescents' health. The second reason is linked to the student's performances. Indeed, people with high subjective well-being are more likely to graduate from college (Frisch et al. 2004). Lastly, numerous studies have demonstrated that long-term happiness precedes the successful outcomes with which it correlates and both long-term happiness. Moreover, short-term positive affects precede desirable resources and characteristics with which they are related (Lyubomirsky et al. 2005).

Measuring feelings represents an important interest in the field of well-being research and in particular in children and adolescents. To date, there are only few scales assessing subjective well-being and positive emotions that are translated and validated in French (e.g., Satisfaction With Life Scale; Diener et al. 1985; Subjective Happiness Scale, Lyubomirsky and Lepper 1999). Nevertheless, recent publications show the dynamism of the field (e.g., David et al. 2013; Gruber and Moskowitz 2014) and consequently the need for more specific measures focused both on positive and negative experiences. Thus it seems necessary to provide a reliable scale in French in order to capture changes in subjective well-being and both positive and negative emotions, in order to assess their evolution and age differences. The existing measures such as the Positive and Negative Affect Schedule (PANAS, Watson et al. 1988) contain items which assess high arousal feelings, and many of them are not considered emotions, such as "active" and "strong" which need not refer to feelings. If a person feels happy, contented, grateful, and loving, it is not captured by the high arousal emotions of the scale. This is why we choose to validate in French and use the Scale of Positive and Negative Experience (SPANE, Diener et al. 2010), which reflects all levels of arousal for both positive feelings (joy, happy, contented) and negative feelings (sad, angry, and afraid). As adjectives are limitless, it is hard to decide how to include them or take into account their overlap. Using the SPANE allows to assess generic feelings that apply to all affect of that valence. This makes the scale more comparable across cultures, as specific emotions are more challenging for a precise translation. Moreover, the emotions assessed with the SPANE items capture the major emotions of many affect theories, and the general words such as "pleasant" and "unpleasant" allow to assess additionally other positive and negative feelings. The new scale SPANE operationalizes thus positive and negative feelings regardless of their specific labels, which allows to assess positive and negative feelings in general.

The main goal of this research is to explore the evolution and age and gender differences and to assess on the short-term positive affects in childhood, adolescence and young adulthood in the French school system. A second goal of this article is to assess the validity and reliability of the SPANE in French in order to reach our main goal and to provide a reliable sound measure in French for the ulterior research on well-being in French speaking countries. The SPANE (Diener et al. 2010) was created to assess a broad range of negative and positive experiences and feelings based on how frequently they were felt over the previous four weeks, which is consistent with research data (Diener et al. 1991) showing that overall judgments of subjective well-being are based

more on frequency of experience than intensity. The scale's items are sufficiently general so that they permit to assess not only the pleasant and unpleasant emotional feelings that are the focus of most scales, but also other states such as interest, flow, positive engagement, and physical pleasure, as described by the author of the scale, along with other interests (Diener et al. 2010).

The first study was designed to test the structural validity of the scale using Exploratory Factor Analysis (EFA). In the second study, the aim was firstly to test the structural validity of the scale using Confirmatory Factor Analysis (CFA). Secondly, because the goal of this article is to explore differences in adolescents' emotions and experiences during the school years, invariance across age and gender of the factorial structure was investigated along with the internal consistency of the scale. It was mainly designed to explore the extent to which older and happier would reflect the truth in French children and adolescents or if some precautions have to be considered. We hypothesized that positive emotions would increase and that negative emotions would decrease. Furthermore, differences in evolution of emotions according to gender were expected. The third study was designed to confirm the second study's results using another measure of emotions.

2 Study 1: Exploratory Analysis of the French Version of the SPANE

2.1 Method

2.1.1 Procedure

We first translated the Scale of Positive and Negative Experience (SPANE) into French according to the Students' transcultural validation procedure developed by Vallerand (1989). The two studies that follow represent the initial validation of the SPANE in French. Two bilingual speakers (English and French) conducted a reverse translation procedure (Brislin 1986) adopted to achieve the version of the SPANE in French, using a back-translation procedure, following a systematic validation methodology. One of the translators translated the scale from English to French, and the other from French to English. Another bilingual English-French speaker, expert in the field, assessed the concordance of the two versions and the consistency of the items, which were tested as well on a small population for the accuracy of the items. This first version was thus composed of 12 items, the same as the original version of the scale.

2.1.2 Participants

Participants were undergraduate university students. All respondents were fully informed regarding the aim of the study. Moreover, all participants were informed about the anonymity and confidentiality of the survey. After that, they decided about their participation in a voluntary manner. A paper and pencil version of the questionnaire was administered during a university psychology lecture to 130 young adults, 115 females (88.5%) and 15 males (11.5%), aged from 19 to 46 years ($M = 22.65$, $SD = 4.80$). The

rules and regulations of the ethics committee of the department of Psychology and Educational Sciences, Paris Ouest Nanterre La Défense University were followed.

2.1.3 Measures

The SPANE is a brief 12-item scale, with six items related to positive experiences and six items designed to assess negative experiences. It assesses the full range of positive and negative experiences. The SPANE is the only self-report instrument that specifically explores the affective component of subjective well-being using both general and specific feelings that reflect a wide range of respondents' emotions and feelings regardless of their culture. The SPANE showed good psychometric properties, with Cronbach's α between .81 and .89 (Diener et al. 2010).

As in the original version in English, each of the 12-item of the French version of the SPANE is scored on a scale from 1 to 5, where 1 represents "very rarely or never" and 5 represents "very often or always". The positive and negative scales are scored separately because of the partial independence or separability of the two types of feelings. The summed positive score (SPANE – P) and the summed negative score (SPANE – N) can range from 6 to 30. The measure can be used to derive an overall affect balance score by subtracting the SPANE-N score from the SPANE-P score for a total balanced score (SPANE-B) that ranges from –24 to 24.

The French version of the SPANE is shown in the appendix section.

2.2 Results and Discussion

Initially we performed a principal component analysis (PCA) with an oblimin rotation considering that both subscales, SPANE – P and SPANE – N are negatively correlated. The results revealed an accurate KMO index of .91. It indicates satisfactory correlations between the items. Furthermore, the results of the Bartlett's test of sphericity are significant ($p < .001$). Therefore not all the correlations are equal to zero. We decided to proceed with the analyses. Different procedure can allow us to determine the number of factors to retain (for a review, see Fabrigar et al. 1999). To diminish the risk of "over-extraction" from the methods of scree test and Kaiser- Guttman criterion – more than one eigenvalue – it was decided to use the Horn's (1965) parallel analysis (PA) method. We used 21.0 TM SPSS software for PCA and computed parallel analysis (PA). A two-component solution with eigenvalues exceeding the own random value generated by the PA was extracted (Table 1). The first two factors account for 51.89% and 16.58% of the variance, respectively.

This exploratory factorial analysis (EFA) with oblimin rotation ($\delta = 0$) finds the original two-dimensional structure of the SPANE (SPANE P and SPANE N), according to Diener's model (Diener et al. 2010). According to Tabachnick and Fidell (2007), results show good factor loadings. However, it is essential not to replicate the original questionnaire "item by item", but to reproduce the theoretical two-partite construction of the original SPANE (Diener et al. 2010). Further studies are needed to confirm or reject this hypothesis. To resume, the EFA with oblimin rotation highlighted a two factors and 12-item solution.

Table 1 Maximum of likelihood exploratory factor analysis with oblimin rotation

	Factor 1	Factor 2	h^2	Skewness	Kurtosis
SPANE1	.83		.69	-.53	.38
SPANE10	.84		.67	-.44	-.14
SPANE12	.59		.49	-.38	-.23
SPANE3	.81		.72	-.41	.09
SPANE5	.95		.79	-.77	1.07
SPANE7	.83		.74	-.73	.39
SPANE11		.59	.33	.10	-.89
SPANE2		.80	.63	.00	-.37
SPANE4		.89	.82	-.04	-.97
SPANE6		.84	.71	.05	-.68
SPANE8		.82	.69	-.03	-.68
SPANE9		.48	.27	.43	-.92
% var	51.89	16.58			
Eigen values	6.23	1.99			
α	.92	.90			

values <.20 haven't been reported

3 Study 2 Differences and Evolution of Emotions across Age and Gender

The general objective of this study was first to test the structural validity of the scale using confirmatory factor analysis. Moreover, it was designed to assess the convergent validity of the scale. In addition to confirming the convergent validity of the scale and its structure, and to explore how emotions evolve, we tested the measurement invariance (MI) across the participants. This allowed us to base further analysis on these results and to explore the mean scores among gender and age. Following the recommendations of Van de Schoot et al. (2012) and Vandenberg and Lance (2000), to explore the MI we first tested the configural invariance in which all parameters are freely estimated between the groups with a factorial structure which was kept constant. Configural invariance is a prerequisite for other invariance tests. Once the configural invariance is established, it is possible to examine weak invariance in which the factors loadings are kept constant. If this invariance is validated, it means that the constructs have the same meaning for all the groups of participants. Then, it is possible to go ahead with the strong invariance where factor loadings and item intercepts are both maintained constant among the groups. This test is designed to ascertain that the groups are compared from the same starting point. With strong invariance, groups can be compared on their scores on the latent variable. At last it is possible to ensure the strict invariance in which the measurement errors are constrained to be equivalent among the groups. It is possible to compute other forms of invariance among the groups (Vandenberg and Lance 2000) but they are not essential to assess the MI (Byrne 2010).

After having ensured the MI among the groups, we computed new analyses to determine if, on average, positive and negative emotions are changing depending age or gender. In order to measure the differences, it is possible to base the analysis on the

mean of the items for each of the two dimensions, and then to compute an ANOVA. However, beyond the observed variables, theoretical constructs can be estimated by their latent variable averages. Indeed, latent variable comparisons represent a superior analytic approach because they account for the random error of measurement for the observed variables associated with each latent variable (Aiken et al. 1994).

3.1 Method

3.1.1 Participants and Procedure

Participants were 1869 students and workers aged 7 to 60 years ($M_{\text{age}} = 20.57$, $SD_{\text{age}} = 8.90$). The sample consisted of Caucasian individuals and the majority were male (633 female and 1233 male, 3 with missing values). Some participants were recruited from fifth grade to university Masters level students. Parental and school administrator permissions were requested before starting the investigation. Some of the participants were full-time employees recruited on the street. All respondents were fully informed regarding the aim of the study. Moreover, all participants were informed about the anonymity and confidentiality of the survey. After that, they decided about their participation in a voluntary manner. All participants completed a demographic questionnaire and the French version of the SPANE.

3.1.2 Measures

We employed a number of well-being measures in order to determine the convergence of the new scale with established measures. For traditional subjective well-being we included the Satisfaction with Life Scale (Diener et al. 1985). We included Watson et al. (1988), which is the most widely used measure of positive and negative feelings. We also administered the Center for Epidemiologic Studies Depression Scale (CES-D; 20 items). This scale initially created by Radloff (1977) has been the subject of an important number of validation studies in different countries, including France (Moullec et al. 2010). It measures a state of depression and can distinguish between four components, including positive and negative emotions, in adolescents and young adults. Participants were asked to respond on a four-point Likert-type scale ranging from “never or very rarely” to “frequently or all the time”. The dimensions of the scale are as follows: DA (Depressed Affect); DIR (Disturbed Interpersonal Relationship); SC (Somatic Complaints); PA (Positive Affect).

3.1.3 Data Analysis

All structural equation modeling analyses in the present study were performed using MPLUS 7.3 with maximum likelihood estimation with robust standard errors (MLR). We use this estimator because it is robust to non-normality of the data.

We first computed a confirmatory analysis with the entire sample (Fig. 1). Then, we ensured the convergent validity of the scale. We initially aimed to determine the best fitting factorial structure of the SPANE. The model was characterized by two latent constructs, namely positive affect and negative affect, in accordance with the original

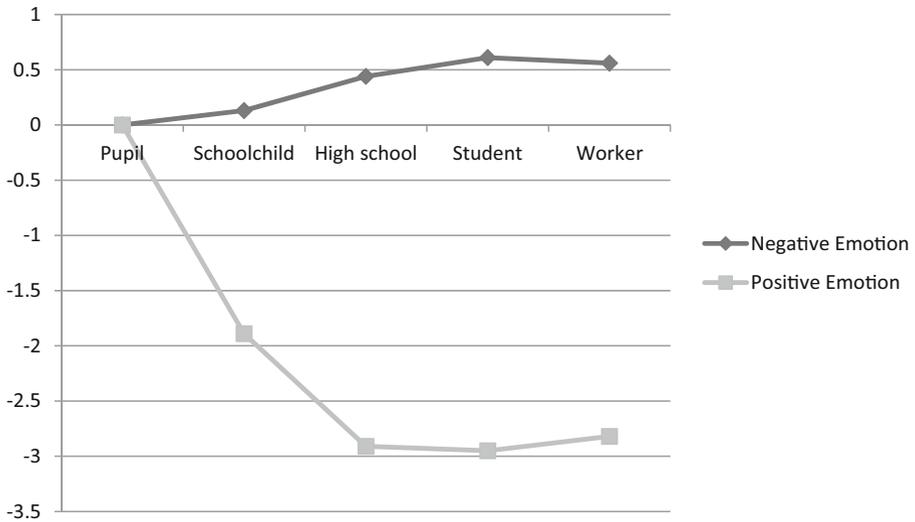


Fig. 1 Latent variables means variation with age (Pupil reference group)

model (Diener et al. 2010). To test this model, CFA was computed. Furthermore, we assessed the reliability of the French version of the SPANE.

Finally, we evaluated how well this factorial structure generalized across age groups and gender. Five categories were used to parse age. They are based on the school organization in France: “*écolier*” (less than 11 years; $n = 199$), “*collégien*” (aged between 11 and 15; $n = 229$), “*lycéen*” (aged between 16 and 18; $n = 274$), students (aged between 19 and 23; $n = 808$), and workers (more than 23 years old; $n = 248$). Eleven persons did not indicate their age.

The measurement invariance of the SPANE across age groups and gender was tested next. In order to do so, we tested increasingly stringent models (see Marsh 1994). Subsequently, we first tested configural invariance, whether the same configuration holds across groups. We then tested weak invariance, by constraining pattern coefficients between each item and its underlying construct to be equal across groups, and strong invariance, by additionally constraining item intercepts also to be equal across groups. Furthermore, we tested strict invariance, by constraining item residuals across groups (Table 3). When testing measurement invariance, Cheung and Rensvold (2002) suggested comparing the ΔCFI statistics of the baseline model with constrained models. Following these recommendations and typical practice with single-group models, as well as studies based on multiple groups, we applied the guidelines for model comparisons based on CFI (the comparative fit index) to the TLI (the Tucker-Lewis index). An advantage of the TLI is that it incorporates a control for parsimony, whereas the change in CFI does not, making TLI particularly relevant to model comparisons (see Marsh et al. 2013). Chen (2007) recommended the use of the ΔCFI , $\Delta RMSEA$, and $\Delta SRMR$ to assess invariance. The criteria for invariance are $\Delta CFI \leq .01$, $\Delta RMSEA \leq .015$ (root-mean-square error of approximation), and $\Delta SRMR \leq .03$ (standardized root-mean square residual).

We used several indices to assess the model fit (Hu and Bentler 1999). First, fit of the model to the data was examined using the chi-square test. A non

significant chi-square indicates that the model was able to replicate suitably the sample covariance matrix. However, there are problems with relying solely on chi-square test because this statistic is sensitive to the size of the correlations and to sample size (see Kline 2010). Consequently, we used additional well-established fit indices to further assess the model fit: one index of absolute fit, SRMR; two indicators of comparative fit, CFI and TLI; and a parsimony corrected fit index, the RMSEA. We used the recommended two-index strategies to assess the fits, with values greater than .95 for CFI and TLI (Bentler 1990; Hu and Bentler 1999), and SRMR and RMSEA values less than .08, which suggest adequate fit (Brown & Cudeck 1989, 1993; Hu and Bentler 1999). Finally, the Akaike's Information Criterion (AIC) was computed.

3.2 Results

3.2.1 Preliminary Analyses

To ensure data normality we tested univariate, bivariate, and Mardia multivariate skewness and kurtosis (Wang and Wang 2012). Results showed that both multivariate skewness and kurtosis are statistically significant, indicating violation of the multivariate normality assumption. This reinforces our choice to use the MLR estimator to perform our analysis with Mplus.

3.2.2 Reliability of the Scale

The reliability of the scale was assessed using Cronbach's Alpha. The results revealed adequate consistency, .90, and .80, respectively, for the subscales of SPANE – P and SPANE – N score.

3.2.3 Confirmatory Factor Analyses

The χ^2 statistics is statistically significant ($\chi^2 = 432.63$; $p < .00$, $df = 31$) however other fit indicators (SRMR = .03; RMSEA = .062 : 90% = > .057–.067; CFI = .96; TLI = .96; AIC = 62,175.06) were good and CFI and TLI above the preferred fit (see Fig. 1).

3.2.4 Convergent Validity

We employed a number of well-being measures in order to determine the convergence of the French version of the SPANE with established measures. For traditional subjective well-being, as did Diener et al. (2010), we included the Satisfaction with Life Scale (SWLS; Diener et al. 1985), Positive And Negative Affects Scale (Watson et al. 1988), and French version of CES-D (Moullec et al. 2010). We presumed that the positive emotions assessed with the SPANE would be positively correlated with the positive emotions assessed with the SWLS score and positive emotion subscale of the PANAS. They were presumed to be positively correlated with positive affects assessed with the CES-D. Conversely, we presumed that positive emotions measured with the SPANE would be negatively correlated with all measures of negative emotions and negative dimensions of CES-D. Negative emotions measured with the SPANE were presumed to

be positively associated with all the other measures of negative affects and negatively with measures of positive affects.

Table 2 presents the basic psychometric statistics for the scale. As expected, positive and negative emotions assessed with the French version of the SPANE are positively or negatively linked to all other chosen measures. The positive SPANE dimension was positively correlated ($r = .52, p < .001$) and its negative dimension was negatively correlated ($r = -.39, p < .001$) with the SWLS (Diener et al. 1985). Positive dimensions of the PANAS ($r = .42, p < .001$) and the CES-D (PA-Positive Affect; $r = .68, p < .001$) were positively correlated with the positive SPANE dimension. Similarly, the negative SPANE dimension was positively correlated with the negative PANAS dimension ($r = .57, p < .001$) and the three negative CES-D dimensions (DA - Depressed Affect; DIR - Disturbed Interpersonal Relationship; SC - Somatic Complaints) are all positively correlated with the negative SPANE dimension (see Table 2). Results reveal that the French version of the SPANE has good convergent validity.

3.2.5 Measurement Invariance

The test of configural invariance for age and gender revealed all acceptable thresholds in conformity with our hypothesis (Table 3). Regarding gender, for the weak invariance and for the strong invariance, the discrepancy for ΔCFI , $\Delta RMSEA$, $\Delta SRMR$ are below or equal to .01. Accordingly, the measure can be considered to be equivalent with the factors' loading and intercepts. On the other hand, the comparison between the configural invariance and the strict invariance shows higher values than desirable. Results reveal, shown in Table 3, that $\Delta CFI = .034$, while $\Delta CFI \leq .01$ was expected. We can conclude that the strict invariance is not fulfilled. This indicates that the part of the variance which is not taken into account is not the same among the groups.

The analysis reveals the same pattern of results for age. The weak invariance and the strong invariance have ΔCFI , ΔTLI , $\Delta RMSEA$, $\Delta SRMR$, which are below or equal to the recommended values (Table 3). On the other hand, strict invariance is considerably above the expected value (Table 3). Accordingly, again the error variance is not the same across all the groups of participants. However, if error variances are not equal,

Table 2 Correlations between SPANE and other scales

	SPANE P	SPANE N	α	n
Spane_N	-.45***	1	.80	1869
SWLS	.52***	-.39***	.88	508
CESD_SC	-.26***	.38***	.63	142
CESD_DA	-.47***	.48***	.87	142
CESD_DIR	-.23***	.30***	.65	142
CESD_PA	.68***	-.40***	.81	142
Panas_P	.42***	-.18*	.77	190
Panas_N	-.27***	.57***	.85	190
α	.90	.80		

*** $p < .001$ * $p < .05$

Table 3 Multiple group tests of measurements invariance over age groups and gender

Model	χ^2	df	CFI	TLI	RMSEA	SRMR	Δ CFI	Δ TLI	Δ RMSEA	Δ SRMR
Age invariance (<i>n</i> = 1861)										
Configural invariance	507.42	265	0.964	0.955	.050 (.043–.056)	0.043				
Weak invariance	572.27	305	0.960	0.956	.049 (.042–.055)	0.058	0.004	-0.001	0.001	-0.015
Strong invariance	670.38	345	0.951	0.953	.050 (.045–.056)	0.062	0.013	0.002	0.00	-0.019
Strict invariance	4139.64	393	0.436	0.527	.160 (.156–.164)	0.230	0.528	0.428	0.110	-0.187
Gender invariance (<i>n</i> = 1864)										
Configural invariance	214.66	106	0.971	0.964	.033 (.027–.040)	0.036				
Weak invariance	228.32	116	0.970	0.966	.032 (.026–.038)	0.040	0.001	-0.002	0.001	-0.004
Strong invariance	265.14	126	0.963	0.961	.034 (.029–.040)	0.042	0.008	0.003	0.001	0.006
Strict invariance	372.49	138	0.937	0.940	.043 (.038–.048)	0.066	0.034	0.024	0.010	0.030

groups can still be compared on the latent variable (Van de Schoot et al. 2012). Further analyses are based on these results to verify the latent means between the groups.

3.2.6 Test of Latent Mean Differences

Support for strong invariance indicates that means can be meaningfully compared across groups. In testing for latent mean differences, the means must be constrained to zero in one group to make the model identified. The estimated means for all other groups represent mean differences in relation to this group. Statistical differences between all groups can be reported between each group and the group constrained to zero. Table 4 shows latent means (with standard errors) between the reference group, and the other groups divided by age. Our results reveal that overall positive emotions decline during the lifespan, and the negative emotions increase. The largest decrease in positive emotions is between “*écoliers*” and “*collégiens*” ($M = -1.89, p < .001$). The other differences are on average much smaller and generally not significant except between high school and college student ($M = -.22, p < .05$). Conversely, negative emotions increase with age, but with mean differences smaller than those observed for positive emotions. Results show that there are no significant differences between “*écoliers*” and “*collégiens*” ($M = .13, p > .05$), nor between “*lycéens*” and students ($M = -.07, p > .05$) or “*lycéens*” and workers ($M = -.06, p > .05$). It is the same between students and workers ($M = .01, p > .05$). These results indicate that there seems to be a significant increase in the negative emotions mainly during the college contrary to what was expected. Older and happier seems not revealing the truth here, and needs a confirmation. Regarding the gender variable, it appears that women have on average more negative emotions ($M = 0.24, p < .001$) and less positive emotions ($M = -.26, p < .001$) than men.

4 Study 3

The results in Study 2 above showed a decrease of positive emotions and increases of negative emotions grow during adolescence, with the most important decrease in positive emotions between “*écoliers*” and “*collégiens*”. These results indicated that there seems to be a significant increase in the negative emotions mainly during the college years instead of a decrease. These results are provocative and intriguing, and need further confirmation. As such, it is important to replicate them with additional scales designed to measure positive and negative emotions in additional samples. The third study was designed to confirm these results by using another scale to assess emotions. An increase in positive emotion and a decrease in negative emotions were presumed as mentioned by Lohani et al. (2014) even if study 2 results might be confirmed.

4.1 Method

4.1.1 Participants and Procedures

Participants were 853 students (51.7% female, 37 students did not indicate their gender) from 9th grade ($n = 473$) and 12th grade ($n = 381$) recruited in 8 schools

Table 4 Latent mean comparisons of positive and negative emotion between subgroups

Negative emotion									
Model	Compare with	M(SE) Neg	p	Compare with	M(SE) Neg	p	Compare with	M(SE) Neg	p
(1)Ecolier									
(2)Collegien	(1)	.13(.12)	>.05						
(3)Lycéen	(1)	.44(.13)	<.01	(2)	.29(.10)	<.01			
(4)Student	(1)	.61(.12)	<.001	(2)	.45(.09)	<.001	(3)	.15(.08)	<.05
(5)Worker	(1)	.56(.13)	<.001	(2)	.40(.10)	<.001	(3)	.11(.09)	>.05
Positive Emotion									
(1)Ecolier									
(2)Collegien	(1)	-1.89(.17)	<.001						
(3)Lycéen	(1)	-2.91(.20)	<.001	(2)	-.15(.12)	>.05			
(4)Student	(1)	-2.95(.18)	<.001	(2)	-.22(.11)	<.05	(3)	-.07(.07)	>.05
(5)Worker	(1)	-2.82(.18)	<.001	(2)	-.20(.11)	>.05	(3)	-.06(.08)	>.05

($M_{\text{age}} = 15.98$ years, $SD_{\text{age}} = 1.63$, youngest =13, oldest =20). Parental and school administrator permissions were requested before starting the investigation. Participants filled in the questionnaires in one single session, and data were collected between May and the beginning of June.

4.1.2 Measures

We used the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff 1977). We included the DA (Depressed Affect) and the PA (Positive Affect)*, because in this study our hypothesis was mainly related to positive and negative emotions.

4.2 Results

Measurement invariance was first ensured to compare latent variables as in the previous study. Results showed that weak, strong, and strict invariances were below the recommended values (Table 5). Indeed, when differences appeared, notably for ΔTLI , which is above .01, they were not going in the direction of a reduction of the adjustment indicators, but indicate an increase. For the strong invariance, TLI value is .93 whereas it is .91 for the configural invariance. The invariance of the measure ensured, differences between latent variables were then tested, constraining to zero the means of the latent variables for positive and negative emotions of the 9th grade students. Results showed significant differences in depressed affect between 9th and 12th grades students ($M = .17$, $se = .08$, $p < .05$). The 12th grade students experienced more negative emotions than do 9th grade students. In contrast, as for Study 2, there was no significant difference in positive emotions between the two age groups ($M = .15$, $se = .09$, ns). Study 3 confirms the overall results of the second study, showing the same change in emotions in young participants. An increase in negative emotions was observed, whereas no significant differences were observed between 9th and 12th grade students.

4.3 General Discussion

Our study shows an increase in negative emotions and experiences in French students adolescents with age. Emotions have been measured using the French version of the SPANE, which is a promising measure, as it shows a good reliability, construct and convergent validity with other measures of emotion, life satisfaction, and affects. In this specific context, the scale appears to be a useful and sensitive measure of both positive and negative experiences, which enables to assess emotion evolution. Due to the inclusion of both “positive” and “negative” feelings, it can assess a wide range of feelings.

Study One, using the EFA identified a two-dimensional structure (SPANE P and SPANE N), according to the Diener’s model (Diener et al. 2010). This two factor model and 12-item solution explained 68.5% of the variance. The goal of Study 2 was threefold: confirming the structure of the scale, ensuring its convergent validity, and testing the evolution of emotions by means of invariance in scores across age and gender. A contribution of the study is that we have confirmed the bidimensional structure of the SPANE using more advanced statistics than used in previous research. The advantage of these statistics is that they provide more certainty of the structure, recognizing factors such as measurement error that are not fully accommodated in older

Table 5 Multiple group tests of measurements invariance over age groups for study 3

Model	χ^2	df	CFI	TLI	RMSEA	SRMR	Δ CFI	Δ TLI	Δ RMSEA	Δ SRMR
Configural invariance	201.19	85	.93	.91	.057 (.047–.067)	.046				
Weak invariance	214.15	94	.93	.92	.055 (.045–.064)	.052	0	-0.01	0.00	-0.01
Strong invariance	228.49	105	.93	.93	.053 (.043–.062)	.055	0	-0.02	0.00	-0.01
Strict invariance	259.58	113	.92	.92	.055 (.046–.064)	.075	0.01	-0.01	0.00	-0.03

(*n* = 853)

statistical approaches. Results of the confirmatory factor analysis revealed strong construct validity. Furthermore, it revealed good convergent validity. The psychometric properties of the French version of the SPANE we present in this article are good, comparable to the original version. Measurement invariance for age and gender revealed all acceptable thresholds in conformity with our hypothesis.

The second and main goal of this article was to examine how emotions vary during the lifespan, and the differences between men and women. Contrary to our hypotheses, results showed that positive emotions declined and negative emotions increased, and that women experienced on average more negative emotions and less positive emotions than men. The third study was designed to confirm these results, using another scale measuring emotions. Results showed the same evolution in emotion in young participants. There was an increase in negative emotions, whereas there is no significant difference between 9th and 12th grade students.

In closing, new research needs to clarify the factors involved in the changes of emotions during adolescence and young adulthood, as well as in differences between men and women. A special attention should be given to the mediators such as the presence of positive resources like trait optimism, trait mindfulness, trait hope, as well as to individuals with particular characteristics such as depressed or addictive adolescents. These findings need further support and understanding of the factors involved in the high levels of negative emotions in adolescence. A better understanding of the processes involved can lead to future developments in both practice and research. Previous research shows that French pupils experience psychological distress, ranging from severe levels of depression (up to 4,4%), to low depression levels (31,7% of them), (Beaulieu 2007). This is consistent with previous surveys like the Program for International Student Assessment (PISA; <http://www.oecd.org/pisa/>) showing the low levels of well-being in French pupils compared to most of the other European countries.

Fenouillet et al. (2014) have shown the decrease in well-being, motivation, and school interest from 5th grade to 12th. Our results converge with those of other studies showing the decrease of intrinsic motivation (Harter 1981; Harter and Jackson 1992; Gillet et al. 2012; Gottfried et al. 2001; Lepper et al. 2005). A characteristic of intrinsic motivation is that student's interest for academic activity is associated with positive emotions. Moreover, intrinsic motivation is highly correlated with emotional well-being, (Hortop et al. 2013). Research shows the decrease of intrinsic motivation between 8 and 16 years and stabilization after that (Gottfried et al. 2001), in line with our other results, which show a stabilization of positive emotions for the "lycéen" group. Consistently, McMakin and Dahl (2014) described the problems associated with the adolescent transition, including risky behaviours such as addictions, suicide, depression, and other affective disorders. Another study showed an increase of 200% in death and disability during adolescence (Ozer et al. 2002). The majority of this increase is related to problems in managing behaviour and in emotional regulation (McMakin and Dahl 2014).

The major contribution of the present research is to provide additional data about how emotions evolve during adolescence, a period during which pupils spend most of their time at school. Our results can lead to a better understanding of the phenomenon. Even if this increase in negative emotions and decrease in positive emotions may be driven in part by maturational changes, it is important to take these points into consideration, and to propose ways to adopt suitable teaching strategies designed to teach pupils how to manage their emotion (e.g., Boniwell and Popovic 2013).

Moreover, mental health is of main concern in schools in many European countries, as childhood and adolescence provide key opportunities to prevent mental health problems. Educational settings could thus promote positive mental health, by providing the child or young adults with resources to thrive and, in adverse conditions, to cope by buffering negative stressors. Schools provide opportunities for interventions, as shown by the numerous mental health interventions in operation across the world, some of which have been evaluated and have shown positive effects (Zins et al. 2004).

The results of our study raise consideration for awareness, assessment, designing intervention, and future research, considering that an increase in negative emotions and a decrease of positive ones can lead to mental disorders. It is thus important to increase adolescents well-being and positive resources by means of fostering of positive emotions. Various methods may be used to foster them. In this direction, Positive Psychotherapy (PPT), which explicitly focuses on cultivating positive emotions and attributes (Seligman et al. 2006; Seligman et al. 2006) can be very helpful, as it has been shown to increase positive emotions in adults and adolescents. In a study on group PPT in mild to moderately depressed college students, results showed that it led to significantly fewer symptoms and increases in life satisfaction compared with the control group. This improvement lasted for at least 1 year after treatment. PPT has also been found to increase the well-being of middle school children, with a large effect size (Rashid and Anjum 2007). In addition, a control group intervention that used PPT exercises with community adults, found enhanced happiness and life-satisfaction with medium effect sizes (Rashid and Anjum 2009). Akther (2009) used PPT exercises with adolescents experiencing addiction problems and found it effective in reducing substance use and in enhancing well-being. It therefore would be necessary to propose this type of intervention in schools, especially in adolescents at risk, who might develop mental disorders such as depression or addictions due to this decrease of positive emotions and increase of negative emotions.

In sum, the contribution of the present research is mainly about showing how emotions evolve during life span, and more precisely during adolescence. Moreover, the development and initial validation of a French version of the SPANE is important, as it ensures the quality of our study and provides a valid and useful measure to assess emotions in French speaking countries. The results of the three studies contribute to the research on well-being and positive and negative feelings by providing a psychometrically sound French version of the SPANE. Moreover, a final important set of findings from this study provide data on how emotions evolve during childhood and in adolescence and with regard to gender differences. It is hoped that this article will encourage investigations to further explore the evolution of positive and negative emotions and well-being especially with the SPANE, which shows very good psychometric qualities.

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