



The seeds of tomorrow: Investigating adolescent perception of the future with the Futures Consciousness scale for adolescents

Fanny Lalot^{a,b,*}, Sanna Ahvenharju^c, Peter C. Bishop^{d,**}

^a Faculty of Psychology, University of Basel, Basel, Switzerland

^b School of Psychology, University of Kent, Canterbury, UK

^c Finland Futures Research Centre, University of Turku, Turku, Finland

^d Teach the Future Inc, Sacramento, USA

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ABSTRACT

Futures Consciousness (FC) describes the human capacity to understand, anticipate, prepare for and embrace the future. Differences in FC between individuals (as a psychological construct) can be reliably measured quantitatively with the Futures Consciousness scale. However, the FC scale is only suitable for the adult population. Based on the contention that Futures Consciousness emerges at a younger age, we endeavour to develop and validate an adapted version of the FC scale that is suitable for adolescents (aged 11–18). This paper presents the statistical analyses that led to the validation of a 15-item instrument, the FC-Adolescent scale. Data from $N = 1138$ adolescents from five countries allowed us to validate the scale in four languages (English, Dutch, Italian, and Turkish) through a dual approach of confirmatory factor analyses and ant colony optimisation item-sampling procedure. The results show that the five-dimensional structure of FC also holds for adolescents and that it can be measured with the scale developed here. Interestingly, we found no correlation between FC and age in the range of 11–18 years old. We discuss implications for research and potential applications for educators and foresight practitioners.

1. Introduction

Foresight practitioners and educators have long recognised the positive impact of foresight activities on individual participants (e.g., [Rhisart et al., 2015](#); [Rohrbeck, 2012](#)). Nowadays, a strong engagement with the future might be even more important for younger people who are facing increasingly uncertain and challenging times (e.g., [Crandon et al., 2022](#)). Fortunately, an increasing number of schools and organisations have started offering courses on future education, foresight, and futures literacy. These courses aim to develop and improve the skills of younger generations, enabling them to conceive alternative futures and understand the variety and complexity of possibilities embedded in our decisions that impact the future (see e.g., [Bol & Staring, 2018](#); [Bol & Wolf, 2023](#)).

However, the validity and effectiveness of futures education is rarely investigated. This lack of evidence might hinder the establishment of new courses, as institutions require demonstrated worth before adding foresight to an already crowded curriculum. Problematically, no suitable tools exist for measuring the impacts of futures education among youth. Therefore, we endeavoured to develop and validate such an instrument, with the hope that it can be integrated into foresight courses. Specifically, in this paper we

* Correspondence to: Fakultät für Psychologie, Missionsstrasse 64a, Basel 4055, Switzerland.

** Corresponding author.

E-mail addresses: fanny.lalot@unibas.ch (F. Lalot), peter@teachthefuture.org (P.C. Bishop).

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present the adaptation, development, and validation of the Futures Consciousness Scale for Adolescents. In the following sections, we briefly describe the construct of Futures Consciousness and the related scale (for adults) before describing our adaptation to make the scale suitable to a younger audience.

1.1. What is Futures Consciousness?

Futures Consciousness (FC) describes the human capacity to understand, anticipate, prepare for, and embrace the future (Ahvenharju et al., 2021). As a construct, FC builds on the idea of humans as anticipatory systems that vary in their capacities to produce, explore, evaluate, and update the predictive models guiding their behaviour (Ahvenharju, 2022). Through their integrated review of futures studies literature, Ahvenharju and colleagues proposed that FC consists of five interconnected dimensions: time perspective, agency beliefs, openness to alternatives, systems perception, and concern for others (Ahvenharju et al., 2018). These five dimensions can be summarised as follows: *Time Perspective* represents an individual's orientation and interest towards future events, as well as their understanding of the way events follow each other over time. *Agency Beliefs* describe the trust one has in their own ability to influence future outcomes and to take successful action to change them. *Openness to Alternatives* refers to the appreciation and understanding of novel future possibilities and potential alternatives to the present. *Systems Perception* represents the capacity of an individual to recognise links, interdependencies, and causalities among and between different systems that influence future outcomes. Finally, *Concern for Others* refers to the understanding of one's own responsibility in relation to other systems, the impacts of one's actions on others, and their future consequences.

Compared to other neighbouring concepts studied in psychology, such as future orientation (Seginer, 2009) or consideration of future consequences (Joireman & King, 2016; Strathman et al., 1994), FC has a relatively broad scope. In addition to including the relatively individual aspects of future time orientation and personal agency, it also encompasses more expansive and societally-oriented perspectives on systems, caring for others, as well as emphasising the openness and unpredictability of future developments per se.

Further empirical support for the construct of FC has been provided by the development of a psychometrically validated instrument, the FC scale,¹ that can be used to measure Futures Consciousness among adults (Lalot, Ahvenharju et al., 2021; Lalot et al., 2020). The adult FC scale consists of 20 items, four per each of the five dimensions. FC can therefore be apprehended as a personal factor with significant and stable variations across individuals.

The FC scale measures participants' *self-reported* and subjective level of Futures Consciousness. One could therefore question whether it captures an actual capacity to think about the future or merely people's perception of their own capacity. Research answers this point: there is evidence that FC matters for individuals' actual engagement with the future. For example, individuals reporting higher FC are more likely to engage in pro-environmental actions and in active citizenship, and to vote regularly (Lalot et al., 2020). In the midst of the COVID-19 pandemic, individuals with high FC also reported greater engagement in prosocial collective action, greater concern and compassion for others, and greater personal well-being (Lalot, Abrams et al., 2021). Therefore, it seems that people are sufficiently aware of their actual future thinking capacity, which the FC scale can adequately capture. In addition, FC seems to be a beneficial capacity, underpinning positive outcomes at both the personal and collective level.

Finally and importantly for our present purpose, the construct of FC has been developed to "encompass and reflect the potential for change and development" (Ahvenharju, 2022, p. 85). It is a combination of individual dispositions (or enduring characteristics of a person) and flexible abilities to contextual changes across the five dimensions (see Ahvenharju et al., 2021). In other words, when it comes to learning, FC describes individuals' capacities to develop futures skills and abilities and is thus well suited for the purpose of assessing the impacts of futures education.

1.2. Futures Consciousness of adolescents

The FC scale was originally developed and intended to be used on adult samples only (Lalot, Ahvenharju et al., 2021; Lalot et al., 2020). Yet, we assume that the phenomenon of Futures Consciousness itself is not only prevalent among adults but could also start emerging at an earlier age. We build this contention on the existing literature on the emergence and development of future time perspective in childhood and adolescence.

In a nutshell, children develop the ability to delay gratification (i.e., discounting an immediate reward for a larger, future reward) at preschool age, hinting at the emergence of future thinking (Göllner et al., 2018). The ability to understand time and focus on the future then increases between the ages of 4 and 9 (Rozek et al., 1977). Many studies have found that children as young as nine years old are able to engage in future thinking and to reflect on their own capability and tendencies, which can be measured with different instruments (Göllner et al., 2018; Lessing, 1972; Mello et al., 2013; Mello & Worrell, 2006, 2015; Nurmi, 1989). It is therefore well ascertained that future thinking exists in (late) childhood and adolescence.

A unique characteristic of the FC scale is its inclusion of other psychological constructs alongside future thinking (i.e., Time Perspective dimension), as mentioned in the previous section. Literature investigating each of the other four dimensions in isolation also supports the idea that they emerge at an early age and exist at adolescence. Regarding *agency beliefs*, developmental studies

¹ In this article we use the term "scale" instead of "survey questionnaire" or "test" since it is the most accurate term for a psychometrically validated instrument. For similar reasons, we use the term "item" to design a single question in a scale. Although these terms come from the field of psychology and are not so common in futures research, we prefer to use them consistently across disciplines.

indicate that children gradually build a sense of personal control over the environment and develop self-efficacy and agency beliefs (Bandura, 1990; Pastorelli et al., 2001), a process that continues in adolescence (for an overview, see Urdan & Pajares, 2006). Concerning *openness to alternatives*, there is some controversy regarding the exact nature and stability of openness as a trait in early childhood (see Herzhoff & Tackett, 2012). In any case, in adolescence openness is a meaningful trait that can be reliably measured. For example, openness in adolescence is positively impacted by increases in cultural activities (Schwaba et al., 2018) and correlates positively (vs. negatively) with the development of a unique (vs. normative) identity (Duriez & Soenens, 2006). Turning to *systems perception*, while this is a complex mode of reasoning that remains challenging even for adults, there is evidence that a preliminary form of systems thinking emerges in preschool children (Feriver et al., 2019). Systems thinking then quickly increases with age and is positively impacted by education and courses aiming at teaching such skills, from elementary to high school (see Lee et al., 2019). In adolescence, it starts resembling that of adults and predicts, for example, positive behaviour change (Moore et al., 2017). Finally, regarding *concern for others*, children as young as 12 months old show proto-empathy towards others; and their prosocial abilities quickly increase with age (see Knafo et al., 2009). Adolescents demonstrate the full capacity to adopt others' perspectives, show concern for them, and otherwise take their wellbeing into account (Overgaauw et al., 2017). Moreover, children gradually increase the circle of 'others' they empathise with and care about as they age, growing from a circle of closest others to a gradual inclusion of more distant groups of people (Dunham et al., 2011; Nesdale et al., 2004), all the way to identifying with 'all of humanity' (Albarello et al., 2021).

In summary, we expect that differences in FC would arise and be visible among adolescents already. However, we lack an instrument that adequately captures such differences. Indeed, while we expect that the structure of FC would be similar among adolescents and adults, the FC scale is not entirely suitable for adolescents due to the complexity of some of the phrases used in the survey items. The purpose of the present study was therefore to adapt the FC scale to suit respondents as young as 11 to 18 years of age. This adapted scale could potentially be used to track the impacts of foresight activities, such as those offered in schools, on adolescents. Further, we aim to recruit adolescent participants from different countries. Indeed, we wanted to ensure that the newly developed scale could be adapted and utilised in different contexts and different languages. While it is always possible to later adapt existing instruments to new languages, it seemed even more appropriate to directly develop it in multiple languages and to provide a direct comparison of scores and scale structure across contexts.

As described in detail in the following section, we therefore worked towards the creation of an adapted instrument, which we then translated into multiple languages and tested across populations of adolescent students in five countries. Statistical analyses provided strong evidence for the validity and reliability of the newly developed Futures Consciousness Scale for Adolescents.

2. Method

2.1. Participating institutions

Different schools were approached to participate in the study. We secured the participation of six schools, one in each of Italy, the Netherlands, Türkiye, and the United Kingdom, and two in the USA.² The research was introduced as an investigation of how young people think about the future. It took the form of an online questionnaire (which could be completed in 5–10 min) and was conducted during class on personal computers. Answers were therefore kept completely anonymous and confidential. Additionally, students were informed that they could stop participating in the study at any point without having to provide a reason.

Given the innocuous nature of the questionnaire and guaranteed anonymity of the responses, many schools considered that parental consent was not necessary. In these schools, we only obtained consent from the teachers. In the two schools that required parental consent, parents and legal guardians were informed about the research two weeks prior to the administration of the questionnaire; they were given the opportunity to opt their children out if they wished to do so.

2.2. Participants

Participants were adolescents aged 11–18 enrolled in one of the participating schools. They participated on a voluntary basis during class time. Of the 1182 students who completed the survey, 44 were excluded as they were outside the target age range. The final sample consisted of 1138 participants (664 female, 424 male, and 50 'other' or undisclosed), with a mean age of 14.00 years ($SD = 1.83$). Demographics by sample are reported in Table 1.

2.3. Materials

2.3.1. Items development

Items were developed and adapted from the original Futures Consciousness scale for adults. The research team collaborated with partnering educators to discuss wordings suitable for individuals aged 11–18. Additionally, new items were developed by the research team and educators experienced in working with youth to ensure an adequate number of potential items for analysis. The primary goal was to develop items that would be easily understandable, both in terms of wording and content, by our young audience. We also

² The schools were identified and approached with the help of the non-profit organisation Teach the Future. Participating schools are listed in the Acknowledgments.

Table 1
Demographics of Each Sample.

	Netherlands	Italy	Türkiye	UK	USA 1	USA 2
Gender (% women)	68.9 %	52.4 %	43.6 %	83.0 %	87.5 %	40.1 %
Age <i>M</i> (<i>SD</i>)	13.76 (1.61)	15.59 (1.49)	12.84 (1.43)	15.05 (1.88)	12.28 (1.06)	14.25 (1.02)
<i>N</i>	293	252	257	88	96	152

consulted with young people from the circle of the research team on certain items. In total, we developed 36 items (20 adapted from the adult scale and 16 original items). This process was initially carried out in English, and the items were subsequently translated. All items are reported in Electronic Supplementary Material (ESM1) alongside the original adult scale.

2.3.2. Translation process

For each language, the items were translated from English into the target language (i.e., Italian, Dutch, and Turkish) by a bilingual native speaker (who was either a member of the research team or a partnering educator), then back-translated by a bilingual native English speaker. Any discrepancies between the original and the back-translated versions were discussed within the team until a consensus was reached.

2.3.3. Procedure and content of the questionnaire

Participants were first asked to indicate their gender (male / female / other / prefer not to say) and their age (in years). They were then introduced to the Futures Consciousness items with the following instruction, “Below is a list of sentences about how people can think about time, about their life, about other people, etc. Please read each sentence carefully and tell us whether it is something that is true of you, personally – or not true of you.” Participants provided their responses on a 5-point Likert scale (1 = *Not true of me at all*, 2 = *Not very true of me*, 3 = *Neutral*, 4 = *True of me*, 5 = *Very true of me*). The 36 items were presented in a randomised order. The questionnaire concluded with a brief debriefing about the aims of the study.

2.4. Analysis strategy

Our aim was to develop a scale that was valid and reliable in each of the tested languages. We strived to obtain a scale that was as similar as possible across language versions but were open to introducing variations if necessary. Additionally, we decided to shorten the scale compared to the adult version for ease of use in school contexts, aiming for a 15-item scale (with three items per dimension of FC). To achieve this, we first conducted analyses on the entire sample (irrespective of language) before refining the suggested solution in each language. We (1) conducted an initial confirmatory factor analysis to detect and remove underperforming items, (2) utilised ant colony optimisation analyses to identify the best overall combination of items (see detail below), (3) tested this retained combination with confirmatory factor analysis in each language sample separately, making adjustments as necessary, and (4) finally examined any potential effect of gender and age on Futures Consciousness scores.

Although it is beyond the scope of the present paper to cover the methods underlying the psychometric analyses necessary to a scale validation, we provide below a brief overview of the analysis strategy.

Confirmatory factor analysis is a technique used to analyse the efficacy of a measurement model where we prespecify that certain items should be grouped together in a determined number of factors, as well as the relationship between these factors. The analysis yields indices of fit that indicate how well the prespecified model fits the data. These indices are compared to threshold values to determine whether the fit is satisfactory or not (see below). The confirmatory factor analysis also provides information about how well each item fits its expected factor, therefore allowing us to identify and eliminate underperforming items within the full model of the theoretical scale (for more details about the CFA approach, see Brown, 2023; Lance & Vandenberg, 2002; see also Brown, 2024, for an openly available textbook on psychometrics).

Ant colony optimisation (ACO) is a “metaheuristic for solving combinatorial optimisation problem” inspired by “the pheromone trail laying and following behaviour of real ants, which use pheromones as a communication medium [...]. The pheromone trails in ACO serve as a distributed, numerical information, which the ants use to probabilistically construct solutions to the problem being solved and which the ants adapt during the algorithm’s execution to reflect their search experience” (Dorigo & Stützle, 2010, p. 227). In other words, an ACO analysis will try to minimise the distance between the different elements being fed to the analysis, while respecting a predetermined structure. It can therefore be utilised to solve many problems such as timetable scheduling, vehicle routing problems, etc. ACO has recently been introduced to psychometrics as a new method to “minimise the distance” between items, i.e., as a way to identify items that share the most commonalities (that are “closer” from one another) while optimising the overall properties of the scale (see Olaru & Danner, 2021).

All analyses were conducted using RStudio (version 2023.03.0 +386), and the following packages: *lavaan* (Rosseel, 2012), *stuart* (Schultze, 2017), *lme4* (Bates et al., 2019), and *lmerTest* (Kuznetsova et al., 2017). All data and code for analysis are publicly available on the OSF: <https://osf.io/wndy2>.

3. Results

3.1. Initial items check

We first conducted a confirmatory factor analysis (CFA) to ensure that the different items loaded onto the expected theoretical dimensions. Therefore, we tested a hierarchical five-factor model where the overarching construct of Futures Consciousness (FC) would be composed of Time Perspective, Agency Beliefs, Openness to Alternatives, Systems Perception, and Concern for Others, and each of these factors would be composed of the theoretically relevant items. Detailed results are reported in ESM2.

To quantify model fit, we relied on different fit indices, including root mean square error of approximation (RMSEA; Steiger & Lind, 1980) and standardised root mean residual (SRMR; Bentler, 1995). Indeed, Hu and Bentler (1999) advise the use of a “2-index presentation strategy” in order to minimise both Type I and Type II errors. RMSEA has, moreover, been declared one of the most informative fit indices (Diamantopoulos & Siguaw, 2000). We also report comparative fit index (CFI; Bentler, 1990) and chi-square. Typically, $CFI \geq .90$, $RMSEA \leq .08$, and $SRMR \leq .09$ indicate an acceptable fit (MacCallum et al., 1996). This first model revealed suboptimal fit to the data, $\chi^2 = 2608$, $df = 555$, $\chi^2/df = 4.70$, $CFI = .763$, $RMSEA = .057$, 90 % CI [.055, .059], $SRMR = .063$. More importantly, it allowed to detect six underperforming items with low loadings on their theoretical factor ($< .30$). These items were removed from the following analyses (see ESM1).

3.2. Ant Colony Optimisation analyses

We then utilised an Ant Colony Optimization (ACO) item-sampling procedure to identify the optimal set of items that would fit the theoretical five-factor model and maximise construct validity (Dorigo & Stützle, 2010; Oлару & Danner, 2021).

We set the analysis parameters based on Oлару et al. (2019)’s recommendations and in accordance with our theoretical expectations. Specifically, we aimed for a 15-item solution, consisting of three items per factor of FC. Additionally, we required that model fit be calculated for a five-dimensional structure with a higher-order factor (FC) composed of the five dimensions. Because it was theoretically important that certain items feature in the new version of the scale, we adjusted their weighting through the “heuristic” parameters (three items were hence put forward: one for the Openness to Alternatives dimension, and two for the Systems Perception dimension, see full code on the OSF, <https://osf.io/wndy2>). Finally and following Oлару et al. (2019)’s recommendations, we split the sample equally into a training subsample ($n = 569$) and a validation subsample ($n = 569$) to cross-validate the retained solution and prevent overfitting (using the “holdout” function; see also Schultze, 2017). We ran the ACO algorithm 10 times with 120 iterations (colonies) and 80 ants per run (on average, each run took approx. 16 min to compute).

With these specifications, the ACO estimated on average 24791 models, ranging from 22320 (seed = 11) to 28320 (seed = 10). The same final solution was achieved in 9 out of 10 runs and was replicated an average of 20 times per run, ranging from 7 (seed = 11) to 43 (seed = 10). The retained model demonstrated a very satisfactory fit, $\chi^2 = 125$, $df = 85$, $\chi^2/df = 1.47$, $CFI = .970$, $RMSEA = .029$, 90 % CI [.017, .039], $SRMR = .035$.

We finally conducted a cross-validation of the retained solution, assessing invariance between the training and the validation subsamples (using the *crossvalidate* function). Results confirmed the factorial structure was similar across both samples in terms of metric invariance (“weak,” $\Delta\chi^2 = 4.57$, $\Delta df = 10$, $p = .92$), scalar invariance (“strong,” $\Delta\chi^2 = 14.67$, $\Delta df = 15$, $p = .48$), and residual invariance (“strict,” $\Delta\chi^2 = 17.59$, $\Delta df = 15$, $p = .29$). All five dimensions were found to be significantly related to the higher-order factor of FC. Detailed results are reported in ESM3.

3.3. Validation in each language

We then proceeded to test the model fit of the newly developed 15-item scale in each language separately (i.e., Dutch, Italian, Turkish, and English). Fit indices are reported in Table 2. Results indicated a satisfactory fit in the Dutch, Italian, and Turkish samples, suggesting that the 15-item scale was valid for use in all three languages (detail and item wordings are reported in Tables 3, 4, and 5). However, the model fit in the English sample was unsatisfactory. Further examination of the results in the different English-speaking

Table 2
Model Fit Indices for the Proposed 15-Item Futures Consciousness Scale for Adolescents, for Each Language Sample.

Sample	N	Model fit indices						
		χ^2	Df	χ^2/df	CFI	RMSEA	95 % CI	SRMR
Dutch	293	117	85	1.37	.952	.036	[.017, .051]	.046
Italian	252	129	85	1.52	.937	.045	[.028, .061]	.059
Turkish	257	113	85	1.33	.958	.036	[.015, .052]	.048
English	336	199	85	2.34	.894	.063	[.052, .075]	.062
UK	88	130	85	1.53	.834	.077	[.049, .103]	.091
USA	248	175	85	2.06	.891	.065	[.052, .079]	.064
USA #1	96	143	85	1.68	.840	.085	[.060, .108]	.090
USA #2	152	171	85	2.01	.832	.081	[.064, .099]	.082

Note. These fit indices pertain to the combination of items suggested by the ACO analysis. This combination was retained for the Dutch, Italian, and Turkish version of the scale; it was refined for the English version (the final English version is described in Table 6).

Table 3

Results of the confirmatory factor analysis testing the structure of the Futures Consciousness scale for adolescents in the Dutch sample.

Items	Estimate	SE	z-test	p-val	β
Time Perspective = ~					
1. Ik denk na over hoe de toekomst er mogelijk uit gaat zien	1.000				.506
2. Bij het maken van een beslissing denk ik na over hoe het mijn toekomst kan beïnvloeden	1.144	.218	5.26	< .001	.484
3. Ik probeer de toekomst te beïnvloeden door mijn dagelijkse gedrag	1.577	.288	5.47	< .001	.705
Agency Beliefs = ~					
4. Ik geloof dat ik in alles kan slagen als ik me ertoe zet	1.000				.628
5. Ik ben altijd optimistisch over mijn toekomst	0.800	.138	5.78	< .001	.611
6. Zelfs als dingen moeilijk zijn red ik me wel	0.686	.137	4.99	< .001	.486
Openness to Alternatives = ~					
7. Ik gebruik vaak nieuwe ideeën om wat ik doe te verbeteren	1.000				.774
8. Ik laat me graag inspireren door nieuwe ideeën	0.789	.102	7.76	< .001	.675
9. Ik vind het leuk om dingen anders te doen dan anders	0.506	.091	5.56	< .001	.377
Systems Perception = ~					
10. Ik geloof dat alles in het universum op een of andere manier met elkaar verbonden is	1.000				.420
11. Ik denk dat alles, van klimaat tot technologie tot onderwijs, verbonden is met elkaar	1.215	.270	4.50	< .001	.531
12. Ik heb vaak het gevoel dat ik onderdeel ben van de natuur	1.341	.296	4.53	< .001	.550
Concern for Others = ~					
13. Ik wil graag mensen helpen, van over de hele wereld, als ze in nood zijn	1.000				.717
14. Ik probeer altijd oprecht, hulpvaardig en vergevingsgezind te zijn	0.634	.097	6.52	< .001	.522
15. Ik probeer bij te dragen aan gelijkheid, rechtvaardigheid, duurzaamheid en een wereld zonder oorlog	0.823	.112	7.34	< .001	.600
Futures Consciousness = ~					
TP	1.000				.717
AB	1.062	.292	3.64	< .001	.504
OA	1.497	.322	4.65	< .001	.759
SP	1.008	.260	3.87	< .001	.716
CO	1.522	.327	4.66	< .001	.746

Note. TP = Time Perspective, AB = Agency Beliefs, OA = Openness to Alternatives, SP = Systems Perception, CO = Concern for Others.

Table 4

Results of the confirmatory factor analysis testing the structure of the Futures Consciousness scale for adolescents in the Italian sample.

Items	Estimate	SE	z-test	p-val	β
Time Perspective = ~					
1. Penso a come potrebbe essere il futuro	1.000				.422
2. Quando prendo una decisione, penso a come questa potrebbe influenzare il futuro	1.708	.338	5.05	< .001	.655
3. Cerco di influenzare il futuro con il mio comportamento giorno per giorno	1.670	.352	4.75	< .001	.663
Agency Beliefs = ~					
4. Credo di poter riuscire in qualsiasi cosa quando decido di farla	1.000				.836
5. Sono sempre ottimista riguardo il mio futuro	0.591	.091	6.46	< .001	.535
6. Anche quando le cose sono difficili riesco a cavarmela abbastanza bene	0.641	.089	7.21	< .001	.650
Openness to Alternatives = ~					
7. Uso spesso nuove idee per modificare il modo in cui faccio le cose	1.000				.808
8. Sono spesso alla ricerca di nuove idee	0.843	.102	8.17	< .001	.661
9. Mi diverto a inventare nuovi modi di fare le cose	0.786	.098	8.02	< .001	.621
Systems Perception = ~					
10. Penso che tutte le cose nell'universo siano in qualche modo tra di loro correlate	1.000				.636
11. Penso che tutto, dal clima alla tecnologia, all'educazione, siano interconnessi	0.973	.164	5.93	< .001	.594
12. Spesso ho la sensazione di essere parte integrante della natura	0.724	.147	4.92	< .001	.456
Concern for Others = ~					
13. In caso di bisogno, voglio aiutare le persone ovunque siano nel mondo	1.000				.554
14. Cerco sempre di essere onesta/o e disponibile e di perdonare gli altri	0.765	.180	4.24	< .001	.412
15. Nella mia vita cerco di supportare l'uguaglianza, la giustizia sociale, la protezione della natura e un mondo in pace	1.216	.235	5.17	< .001	.633
Futures Consciousness = ~					
TP	1.000				.751
AB	1.004	.322	3.12	.002	.350
OA	1.838	.476	3.86	< .001	.720
SP	1.501	.388	3.87	< .001	.724
CO	1.111	.301	3.70	< .001	.661

Note. TP = Time Perspective, AB = Agency Beliefs, OA = Openness to Alternatives, SP = Systems Perception, CO = Concern for Others.

subsamples (i.e., the UK sample, and the two USA samples considered together or separately) also demonstrated unsatisfactory fit in each case.

Therefore, we sought to adapt the English version of the scale to ensure its validity. Investigating items loadings, we identified two

Table 5

Results of the confirmatory factor analysis testing the structure of the Futures Consciousness scale for adolescents in the Turkish sample.

Items	Estimate	SE	z-test	p-val	β
Time Perspective = ~					
1. Gelecekte bir şeylerin nasıl olabileceğini düşünürüm	1.000				.508
2. Bir karar verdiğimde bunun gelecekte olayları nasıl etkileyebileceğini düşünürüm	1.448	.224	6.48	< .001	.651
3. Günlük davranışlarımla gelecekteki olayları etkilemeye çalışırım	1.456	.234	6.24	< .001	.622
Agency Beliefs = ~					
4. Karar verdiğimde her şeyi başarabileceğime inanıyorum	1.000				.539
5. Kendi geleceğim hakkında her zaman iyimserimdir	0.946	.248	3.81	< .001	.465
6. İşler zorlaştığında bile durumu oldukça iyi idare edebilirim	0.837	.207	4.04	< .001	.474
Openness to Alternatives = ~					
7. İşleri yapma biçimimi değiştirmek i ç in genellikle yeni fikirlerden faydalanırım	1.000				.549
8. Sık sık yeni fikirler arayımdayım	1.082	.167	6.49	< .001	.568
9. Bir şeyler yapmanın yeni yollarını düşünmekten zevk alıyorum	1.435	.187	7.63	< .001	.732
Systems Perception = ~					
10. Evrendeki her şey bir şekilde diğer her şey ile bağlantılıdır	1.000				.360
11. İklimden teknolojiye veya eğitime kadar her şeyin birbiriyle bağlantılı olduğunu düşünürüm	1.511	.326	4.64	< .001	.522
12. Doğanın bir parçası olduğumu sıklıkla hissederim	1.592	.366	4.35	< .001	.529
Concern for Others = ~					
13. Dünyanın her yerindeki insanlara ihtiyaçları olduğunda yardım etmek isterim	1.000				.667
14. Her zaman dürüst, yardımsever ve affedici olmaya çalışırım	0.858	.136	6.31	< .001	.521
15. Hayatımda eşitliği, sosyal adaleti, doğayı korumayı ve barış i ç inde bir dünyayı savunmaya çalışırım	1.204	.184	6.54	< .001	.714
Futures Consciousness = ~					
TP	1.000				.936
AB	0.650	.170	3.82	< .001	.515
OA	1.190	.219	5.44	< .001	.938
SP	0.878	.201	4.37	< .001	.969
CO	0.744	.159	4.67	< .001	.565

Note. TP = Time Perspective, AB = Agency Beliefs, OA = Openness to Alternatives, SP = Systems Perception, CO = Concern for Others.

items with loadings visibly lower than the others (one Time Perspective, “I think about how things might be in the future” and one Concern for Others item, “I always try to be honest and helpful, and to forgive others”). We ran different iterations of the model, each time replacing the underperforming item with another available item contributing to the same factor. We first investigated and found a replacement for the Concern for Others item: “I care for my schoolmates and teammates”, then did the same for the Time Perspective

Table 6

Results of the confirmatory factor analysis testing the structure of the Futures Consciousness scale for adolescents in the English-speaking sample.

Items	Estimate	SE	z-test	p-val	β
Time Perspective = ~					
1. I think often about what tomorrow might bring*	1.000				.445
2. When I take a decision, I think about how it might affect things in the future	1.472	.227	6.49	< .001	.610
3. I try to influence things in the future with my day-to-day behaviour	1.819	.286	6.37	< .001	.790
Agency Beliefs = ~					
4. I believe I can succeed at anything when I set my mind to it	1.000				.780
5. I am always optimistic about my future	0.955	.100	9.53	< .001	.644
6. Even when things are difficult, I can manage quite well	0.925	.093	9.90	< .001	.689
Openness to Alternatives = ~					
7. I often use new ideas to modify the way I do things	1.000				.600
8. I am often on the lookout for new ideas	1.190	.141	8.42	< .001	.678
9. I enjoy thinking up new ways of doing things	1.311	.149	8.81	< .001	.704
Systems Perception = ~					
10. I think everything in the universe is somehow related to everything else	1.000				.606
11. I think that everything, from the climate to technology or education, is connected	1.178	.162	7.26	< .001	.717
12. I often feel like I am a part of nature	0.948	.142	6.68	< .001	.535
Concern for Others = ~					
13. I want to help people all over the world, when they are in need	1.000				.747
14. I care for my schoolmates and teammates*	0.638	.099	6.48	< .001	.531
15. In my life, I try to support equality, social justice, nature protection, and a world at peace	0.805	.117	6.87	< .001	.632
Futures Consciousness = ~					
TP	1.000				.698
AB	1.368	.280	4.88	< .001	.525
OA	1.727	.369	4.68	< .001	.966
SP	1.128	.257	4.40	< .001	.501
CO	0.705	.210	3.35	.001	.311

Note. TP = Time Perspective, AB = Agency Beliefs, OA = Openness to Alternatives, SP = Systems Perception, CO = Concern for Others. Items marked with an asterisk * differ from the other language versions. Specifically, item TP1 replaces “I think about how things might be in the future”, and item CO14 replaces “I always try to be honest and helpful, and to forgive others”.

item: “I think often about what tomorrow might bring”. With these two changes, the model fit was finally satisfactory, $\chi^2 = 154$, $df = 85$, $\chi^2/df = 1.81$, CFI = .937, RMSEA = .049, 90 % CI [.036, .061], SRMR = .050 (see details and wording in Table 6).

3.4. Descriptive statistics of the newly developed FC scale for adolescents

Descriptive statistics of the FC scale for adolescents for each sample are reported in Table 7. The scale showed satisfactory internal consistency in each language, as indicated by Cronbach's $\alpha > .76$ (McDonald's $\omega_T > .80$). Furthermore, the scores followed a normal distribution, with an average only slightly above the scale's midpoint.

3.5. Effects of age and gender

Before concluding, we examined whether age and gender were related to differences in average FC scores. We conducted a multilevel regression analysis including age (continuous score) and gender (coded as $-1 = \text{male}$, $+1 = \text{female}$) as predictors, and using Sample as the Level 2 grouping variable (Level 1 = individual). The analysis revealed a significant, albeit small, effect of gender, with female respondents reporting higher average FC scores ($M = 3.63$, $SD = 0.49$) than male respondents ($M = 3.59$, $SD = 0.56$), $t(1031) = 2.31$, $p = .021$, Cohen's $d = 0.14$, 95 % CI [0.02, 0.26]. Follow-up tests revealed that this difference was mostly due to female respondents scoring higher on the Concern for Others dimension (see ESM4). There was no significant effect of age, $t(687.5) = 0.59$, $p = .55$, $d = 0.04$, 95 % CI [-0.10, 0.19]. Finally, the intraclass coefficient was very small (ICC = 0.01), indicating that most of the variance was between individuals (99 %) and not between samples (1 %).

4. General discussion

The purpose of the present study was to adapt and validate the Futures Consciousness (FC) scale (Lalot, Ahvenharju et al., 2021; Lalot et al., 2020) for an adolescent population aged 11–18. Indeed, whilst there is theoretical and empirical evidence to suggest that Futures Consciousness begins developing at an early age and differences among individuals can already be present during adolescence (see Introduction), the existing FC scale for adults was not suitable to capture such variations due to the complexity of the items.

Results from over 1000 adolescents across five countries support our proposition that the phenomenon of FC exists among youth and can be reliably measured. Furthermore, the results were remarkably consistent across samples: a completely identical scale was found to be reliable for three of the four languages investigated, and only two items required adaptation to provide a suitable solution for the fourth language (English). This finding, reinforced by the minimal variation between countries identified in the multilevel analysis, suggests that Futures Consciousness could be universal, at least to a certain degree, as its structure appears to be relatively independent of linguistic and cultural factors. The results also suggest that FC in adolescence has the same structure and consists of the same psychological components as it does in adulthood (i.e., the five subdimensions of FC were similarly interrelated). Consequently, we conclude that the present study successfully adapted the FC scale and developed a valid and reliable instrument for adolescents.

Our results did not reveal any difference in FC scores related to age, which is consistent with several other findings. Indeed, while developmental theories hold that time orientation may change during adolescence (e.g., Piaget, 1955), experimental findings have been mixed. It seems that time orientation mostly develops during childhood, with important age-related differences in time understanding and delay of gratification tasks from age 4 to 9 (Rozek et al., 1977). However, studies focusing on late childhood and adolescence have often found no difference due to age (see Mello & Worrell, 2015, for a review). For instance, Mello and Worrell (2006) observed no difference in future time perspective measured with the Zimbardo Time Perspective Inventory among 11-to-18-year-old. Mello et al. (2013) also found no difference among 12-to-19-year-old on the Adolescent Time Inventory. Göllner et al. (2018) found no difference in delay of gratification, delay discounting, or future time perspective, between a 9–14 and a 18–25 year-old group; although the older group provided verbal descriptions of possible futures (episodic future thinking) of better quality. The present results, showing no difference in FC scores among our 11-to-18-year-old participants, are therefore in line with the existing literature. This suggests that the main elements of Futures Consciousness may develop already at a rather early age.

The results also revealed a small effect of gender, with female respondents scoring higher on the FC scale than male respondents. Follow-up tests showed that this effect was in fact mostly driven by differences in the Concern for Others dimension. Given the large literature that indicates greater empathy and prosocial behaviour among female compared to male adults and teenagers (e.g., Rochat, 2023; Overgaauw et al., 2017; Van der Graaff et al., 2018), this finding may not come as a surprise. On the other dimensions of FC, however, scores were very similar with only small differences arising (see ESM4). We therefore conclude that male and female teenagers have, on average, a similar orientation towards Futures Consciousness – which is consistent with other work showing no or only small gender differences in future time perspective or time orientation (e.g., Mello & Worrell, 2006; Mello et al., 2013).

4.1. Limitations and further development

We focused here on testing the reliability and validity of the new instrument, and thus it was beyond the scope of the present research to assess how Futures Consciousness scores would change as a result of educational interventions. In the original development of the scale for adults, it has been suggested that the scale could capture changes in FC as individuals improve and acquire new skills, but this aspect remains to be tested. We are aware of one recent study that examined changes in FC scores over the course of one year following a futures thinking class (at a university); this study found a significant increase in FC among (adult) students at the end of the year (Bol & de Wolf, 2023). However, another study found that participation in a workshop did not have a significant impact on FC

Table 7
Descriptive statistics of the FC Scale for adolescents in each language.

Sample	α / ω_T	$M (SD)$	Skewness	Kurtosis (SE)
Dutch	.76 /.80	3.51 (0.50)	-0.48	1.87 (0.29)
Italian	.78 /.82	3.56 (0.50)	0.24	-0.32 (0.31)
Turkish	.80 /.83	3.78 (0.57)	-0.35	0.03 (0.31)
English	.77 /.82	3.59 (0.52)	-0.24	-0.19 (0.28)
Total	.78 /.81	3.61 (0.53)	-0.16	0.25 (0.15)

Note. α = Cronbach's alpha, ω_T = McDonald's omega total. The scale adopts a 5-point format.

scores, which may suggest that impacts of short-lasting interventions cannot be measured with this scale (Armanto, 2024). Therefore, it remains for future research to explore similar improvements in FC following classes and workshops among adolescents – and it is our hope that the newly developed FC scale for adolescents can be utilised for this purpose.

Second, our comparison between samples (i.e., between countries) was limited as the samples varied across many aspects: not only in terms of cultural and linguistic factors but also in average age, gender distribution, and the nature of the schools (selective, private, or public), among others. Utilising representative and more controlled samples from diverse countries will be necessary to systematically assess intercultural differences in FC scores. It was initially suggested that the conceptualisation of FC might be culturally biased towards Western worldviews (Ahvenharju et al., 2021) and there is evidence for cultural variations in some of the psychological constructs related to FC, such as systemic and holistic thinking (e.g., Choi et al., 2007). Therefore, it is conceivable that distinct patterns or profiles of FC may emerge across cultures – a possibility that future research will need to address.

4.2. Implications and potential use for the FC-Adolescent scale

Schools and other organisations that aim to incorporate futures thinking or futures literacy into their curriculum require empirical justification that teaching about futures has some beneficial effect. While futures education has numerous beneficial outcomes, not all of which can be measured, the newly developed FC-Adolescent scale allows for the measurement of the extent to which students possess the abilities and tendencies associated with Futures Consciousness. The use of the scale is therefore potentially twofold. Firstly, it can be used as a 'pre-test' assessment to determine the level of FC within a class or school, as well as variations between individuals; which can then be utilised to develop tailored interventions that focus on the dimensions of FC most lacking, or to provide additional support to students less advanced in FC. Secondly, the scale can be used to quantitatively assess the effectiveness of courses, classes, and interventions through pre- and post-measurements. It is our hope that the scale proves beneficial to future educators, not only in demonstrating the impacts of their work but also in helping them develop their activities. Furthermore, it presents interesting possibilities for studying and comparing different types of educational interventions and their impacts, as well as exploring various factors that may influence the level of FC among youth.

Finally, applied at a large scale, the FC-adolescent scale may inform us about population trends in future thinking. Contrary to popular belief, research shows that children's delay of gratification ability has *ameliorated* over the past 50 years (Carlson et al., 2018), an effect that might be due to a parallel increase in IQ (Protzko, 2020). However, this trend might stabilise or even reverse in future generations. Instruments such as the FC-adolescent scale may contribute to better tracking and understanding such dynamics across societies.

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CRedit authorship contribution statement

Sanna Ahvenharju: Writing – review & editing, Writing – original draft, Supervision, Resources, Methodology, Investigation, Conceptualization. **Fanny Lalot:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Peter C. Bishop:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Investigation, Funding acquisition, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

All data and code for analysis are publicly available on the OSF: <https://osf.io/wndy2>.

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